

(19)日本国特許庁 (J P)

(12)公開特許公報 (A)

(11)特許出願公開番号

特開平5-313226

(43)公開日 平成5年(1993)11月26日

(51)Int.Cl.<sup>5</sup>

G03B 9/10

19/12

識別記号

A 7820-2K

7348-2K

F I

審査請求 未請求 請求項の数23 (全16頁)

(21)出願番号 特願平4-120604

(22)出願日 平成4年(1992)5月13日

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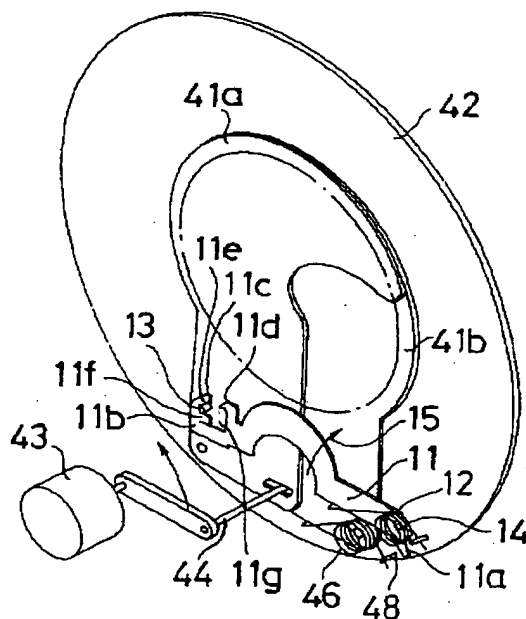
(54)【発明の名称】 カメラ用シャッタ装置

(57)【要約】

【目的】 撮影準備状態等において、シャッタアクチュエータコイルの消費電流を低減し、省電力化を図るとともにアクチュエータコイルの熱変形を防止する。

【構成】 シャッタ羽根開閉駆動手段により駆動されるシャッタ羽根を有し、シャッタ羽根により被写体像の光路の開閉を行なうカメラ用シャッタ装置において、シャッタ羽根を開状態及び／又は開状態に係止する係止手段を有し、シャッタ羽根開閉駆動手段により係止手段の係止や係止解除を行なわしめる構成とした。

図1



## 【特許請求の範囲】

【請求項 1】 シャッター羽根開閉駆動手段により駆動されるシャッター羽根を有し、該シャッター羽根により被写体像の光路の開閉を行なうカメラ用シャッター装置において、固定部に設けられた第 1 係止部材とシャッター羽根に設けられた第 2 係止部材とからなり、シャッター羽根を開状態に係止する閉係止手段を備え、該閉係止手段は、シャッター羽根開閉駆動手段により係止、係止解除が行なわれるカメラ用シャッター装置。

【請求項 2】 請求項 1 において、該閉係止手段は該シャッター羽根の該シャッター羽根開閉駆動手段による閉方向付勢力により閉状態係止、再度閉方向付勢力を加え閉状態係止解除を行なうプッシュプッシュ式係止手段であり、該シャッター羽根閉状態係止中に該シャッター羽根開閉駆動手段が該シャッター羽根に閉方向付勢力を加えた後シャッター羽根開方向駆動を行なうカメラ用シャッター装置。

【請求項 3】 請求項 1 において該閉係止手段は該シャッター羽根の該シャッター羽根開閉駆動手段による閉方向付勢力により弾性部材を乗り越えて係止開方向付勢力により再度弾性部材を乗り越えて係止解除を行なう弾性係止手段であるカメラ用シャッター装置。

【請求項 4】 請求項 1 において該閉係止手段は該シャッター羽根の該シャッター羽根駆動手段による閉方向付勢力で吸着係止、開方向付勢力により吸着離脱係止解除を行なう磁気係止手段であるカメラ用シャッター装置。

【請求項 5】 シャッター羽根を開状態に係止する閉係止手段を備えたカメラ用シャッター装置において、シャッター羽根開閉駆動手段により該シャッター羽根と該閉係止手段の係止、係止解除を行なうカメラ用シャッター装置。

【請求項 6】 シャッター羽根を開状態に係止する閉係止手段と開状態に保持する開係止手段を備えたシャッター装置において、シャッター羽根開閉駆動手段により該シャッター羽根と該閉係止手段、開係止手段の係止、係止解除を行なうカメラ用シャッター装置。

【請求項 7】 請求項 5 又は 6 において露光時には該閉係止手段による該シャッター羽根の開状態係止を禁止する禁止手段を設けたカメラ用シャッター装置。

【請求項 8】 請求項 7 において該禁止手段は被写体像をフィルム面に導く光路と接眼面へ導く光路を互いに切替えるミラー手段に機械的に連動しており、被写体像を接眼面上に導く光路を形成する該ミラー手段のミラー状態以外では該禁止手段が該シャッター羽根の該閉係止手段による閉係止を禁止するカメラ用シャッター装置。

【請求項 9】 シャッター羽根開閉駆動手段により駆動されるシャッター羽根を有し、該シャッター羽根により被写体像の光路の開閉を行なうカメラ用シャッター装置において、シャッター羽根開方向付勢弾性手段と、少なくともシャッター羽根閉方向駆動を行なうシャッター羽根駆動手段と、シャッター羽根を開状態に係止する係止手段と、該係止手段を駆動して少なくともシャッター羽根の係止解除を

行なう係止駆動手段を備え、該係止駆動手段を形状記憶合金部材としたカメラ用シャッター装置。

【請求項 10】 請求項 9 において該形状記憶合金部材はワイヤ状であり、該ワイヤ状形状記憶合金部材の延出方向を変更するピンを有するカメラ用シャッター装置。

【請求項 11】 請求項 10 において、該ピンには該ピンに当接する複数の該ワイヤ状形状記憶合金部材を互いに接触させない案内手段を設けたカメラ用シャッター装置。

10 【請求項 12】 請求項 10 において、該ピンには該ワイヤ状形状記憶合金部材の延出方向以下の周囲を被う案内手段を設けたカメラ用シャッター装置。

【請求項 13】 請求項 9 において、該形状記憶合金部材は該シャッター羽根駆動手段であるコイルと半導体素子を介して直列接続されているカメラ用シャッター装置。

【請求項 14】 請求項 9 において、係止駆動手段を使用後所望時間の間は該係止手段による閉係止は行なわないカメラ用シャッター装置。

20 【請求項 15】 請求項 14 において該所望時間の間にシャッター羽根閉状態にする時はシャッター羽根駆動手段により閉方向付勢を行ない、該所望時間経過後は該係止手段による閉係止を行なうカメラ用シャッター装置。

【請求項 16】 シャッター羽根開閉駆動手段により駆動されるシャッター羽根を有し、該シャッター羽根により被写体像の光路の開閉を行なうカメラ用シャッター装置において、撮影状態及び撮影準備状態以外ではシャッター羽根を開状態に保持する閉保持手段を備えたカメラ用シャッター装置。

【請求項 17】 請求項 16 において該閉保持手段は電源スイッチに機械的に連動され、電源スイッチオフ時に該シャッター羽根を開状態に保持する機構であるカメラ用シャッター装置。

【請求項 18】 請求項 16 において該カメラはレンズ部分をカメラボディに収納する沈胴手段を具備し、該閉保持手段は該沈胴手段と機械的に連動され、該レンズ部分を該カメラボディに収納時に該シャッター羽根を開状態に保持する機構であるカメラ用シャッター装置。

【請求項 19】 請求項 17 又は 18 において該閉保持手段は該シャッター羽根を開状態に係止する係止手段であるカメラ用シャッター装置。

【請求項 20】 請求項 17 又は 18 において該閉保持手段は該シャッター羽根を開状態に付勢する付勢手段であるカメラ用シャッター装置。

【請求項 21】 請求項 16 において該保持手段による該シャッター羽根閉保持を解除する解除手段を備えたカメラ用シャッター装置。

【請求項 22】 請求項 21 において該カメラは被写体像を接眼面へ導く光路とフィルム面へ導く光路を互いに切替えるミラー手段を具備し、該解除手段は該ミラー手段と機械的に連動され、該ミラーの動作により該光路が

被写体像をフィルム像面に導かれた直後に該シャッタ羽根の閉状態保持を解除するカメラ用シャッタ装置。

【請求項 2 3】 請求項 1 6 において該カメラは被写体像を接眼面へ導く光路とフィルム面へ導く光路を互いに切換えるミラー手段と該ミラー手段を駆動するミラー駆動手段を具備し、該保持手段は該ミラー駆動手段と機械的に連動され、該ミラー手段の動作により該光路が被写体像をフィルム面に導かれる直前に該シャッタ羽根の閉状態を保持し、被写体像がフィルム面に導かれた後にも該ミラー駆動手段を駆動する事で該シャッタ羽根閉保持を解除する構成であるカメラ用シャッタ装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、スチルカメラにおけるシャッタ装置に関し、特に被写体像をカメラフィルム面に導く光路と接眼面に導く光路とを互いに切換えるミラーを有するレンズシャッターカメラ用のシャッタ装置に関する。

【0002】

【従来の技術】1眼レフレックスカメラにおいては、被写体像をフィルム面に導く光路と接眼面に導く光路を互いに切換えるミラーよりも、フィルム側にシャッタ機構を有している。そのためミラーとフィルム間にスペースが必要であり、又、フィルム直前にシャッタが設けられている為、シャッタ開口形はフィルム露光面以上大きくする必要があり、シャッタ駆動部はその外側に配置される為どうしても大型化してしまう。そして入射光量調整用の絞りも別に設ける必要がありコスト高にもなり重量も増してしまう。又、シャッタは高速時フィルム面上をスリット状に露光してゆく為、ストロボを閃光させる場合、露光ムラが出来てしまい、それを防ぐ為ストロボ使用時高速シャッタが出来ない欠点があった。

【0003】そこで近年において上記の欠点が無いレンズシャッタをミラーよりも被写体側に配置されたカメラも出現して来ている。

【0004】その様なカメラにおいてはミラーが十分な遮光機能を有しておりミラーダウン時（ミラーが被写体像を接眼面に導く光路を形成する状態：以下ミラーダウンという）には、フィルム面に光が漏れない様な構造になっており、この時レンズシャッタは開放で被写体が接眼部を通して見える様になっている。そして撮影時にはシャッタが閉まり、次にミラーアップ（ミラーが被写体像をフィルム面に導く光路を形成する状態：以下ミラーアップという）状態になりフィルム面への遮光を止める。（シャッタ閉の為遮光は行なわない。）その後シャッタが開閉され露光終了後ミラーダウンし、最後にシャッタ開で完了するシーケンスになっている。

【0005】そして撮影状態や撮影準備状態（レンズキャップを外したり、何らかの操作を行なっている状態）ばかりでなくカメラ未使用時（カメラを放置している状

態やカメラを持ち歩いている状態）においてもシャッタは開いており、ミラー遮光でフィルムへの光漏れを防いでいる。

【0006】しかしこの様にミラーを有するカメラにおいては、写す像そのものがファインダーを通して確認できる大きな利点があるものの、ミラー及びその揺動の為のスペースを必要とする。その為カメラ未使用時にはミラーのスペースにレンズが収納されてコンパクトになるカメラの開発が進められている。

【0007】図19はその様なカメラの断面図を示しており、51はレンズシャッタ、52はミラー、53はフィルム面、54は接眼面、55は鏡筒、56はカメラ本体、57はミラーに反射された被写体像を接眼面に導くプリズムである。

【0008】図19においてカメラ未使用時に不図示の電源スイッチを切るとミラー52が破線の状態にミラーアップし、ミラーの退避したスペースに鏡筒55が沈胴して収納される。

【0009】この様な構成になっているとカメラ未使用時にはミラーアップしている為ミラーによる遮光は望めず、遮光の為にシャッタを閉状態に保持しておく必要がある。その為全体のシーケンスは電源スイッチオンで鏡筒がせり出し、次にミラーダウンしてフィルム面への遮光を行ない、シャッタ開放にして接眼面に光路を導く。撮影時のシーケンスは前述の通りであり、カメラ未使用の為電源スイッチを切ると、始めにシャッタが閉じ、次にミラーアップして鏡筒の沈胴を行なう。

【0010】

【発明が解決しようとする課題】以上の様にカメラ未使用時にはシャッタ羽根が閉状態である必要があり、これは従来のレンズシャッタの様にシャッタ羽根を閉方向にバネ付勢をしておけばよい。

【0011】図18は従来のレンズシャッタを示しており、シャッタ羽根41a、41bは各々シャッタ地板42に立てられたピン45a、45b回りに回転可能に支持され、シャッタ羽根41a、41bに各々設けられた長孔41c、41dにシャッタアクチュエータ43のレバーピン44が嵌合しレバーピン44の矢印47方向の回転により、シャッタ羽根41a、41bの開放動作を行なう。又、シャッタ羽根41aにはバネ46が掛けられておりシャッタ羽根41a、41bの閉方向付勢を行なっている。そのため通常（カメラ未使用時）ではバネ46によりシャッタ羽根は閉状態になっており、シャッタアクチュエータ43によりバネ46に逆らってシャッタ羽根の開放動作を行なう。

【0012】しかしこの様なレンズシャッタをカメラに適用する事を考えると以下に示す不都合な状態に陥る。

【0013】前述した様にカメラ撮影準備状態においてはミラー52がミラーダウンし、被写体像を接眼面に導く光路を形成しなくてはならない。この時シャッタ51

のシャッタ羽根は開状態にある事が必要で、シャッタアクチュエータ 4 3 はバネ 4 6 のシャッタ羽根閉方向付勢力に常に逆らって開状態を保持しておく必要がある。その為撮影準備状態においてはシャッタアクチュエータコイルの消費電流量が多く、又コイル自身の発熱量も多くなる。一般に撮影準備状態は撮影時よりも長く、又電源スイッチの切り忘れにより常に撮影準備状態になっている事も考えられる為電池の消耗ばかりでは無く、シャッタアクチュエータコイルの発熱によるコイルの変形や、発熱による他に及ぼす影響も避けられなくなると言う問題があった。

## 【 0 0 1 4 】

【課題を解決するための手段及び作用】本発明の第 1 群の解決手段は、請求項 1 乃至 8 に記載の構成を有し、レンズシャッタ機構と、被写体像をフィルム面へ導く光路と接眼面へ導く光路を互いに切換える遮光性を有するミラー機構を備え、未使用時にはミラー機構は被写体像をフィルム面へ導く光路を形成し、ミラー機構が被写体像を接眼面に導く光路を形成する為に位置していたスペースにレンズが沈胴収納される事で、シャッタ羽根を閉状態或いは開状態もしくはその両状態に係止する係止手段を有し、シャッタ羽根開閉駆動手段により係止手段によるシャッタ羽根の係止、係止解除を行なう事により上述問題点を回避したものである。

【 0 0 1 5 】本発明の第 2 群の解決手段は、請求項 9 乃至 1 5 に記載の解決手段を有し、被写体像を接眼面へ導く光路とフィルム面へ導く光路を互いに切換える遮光性を有するミラーを設け、カメラ未使用時には該ミラーは被写体像をフィルム面へ導く光路を形成し、該ミラーの被写体像を接眼面に導く光路を形成する為に位置していたスペースにレンズが沈胴収納される事で小型化される構成のカメラにおいて、該ミラーより被写体側にレンズシャッタ機構を設け、該レンズシャッタはシャッタ羽根開方向付勢バネと、少なくともシャッタ羽根閉方向駆動を行なうシャッタ羽根駆動装置と、シャッタ羽根を閉状態に係止する係止手段と、該係止手段を駆動して少なくとも係止解除を行なわせる形状記憶合金部材の係止駆動手段を設ける事で上述問題点を回避したものである。

【 0 0 1 6 】本発明の第 3 群の解決手段は、本発明によれば撮影状態及び撮影準備状態以外ではシャッタ羽根を閉状態に保持する閉保持手段を設ける事で上述問題点を回避したものであり、詳しくは被写体像を接眼面へ導く光路とフィルム面へ導く光路を互いに切換える遮光性を有するミラーを設け、カメラ未使用時には該ミラーは被写体像をフィルム面へ導く光路を形成し、該ミラーの被写体像を接眼面に導く光路を形成する為に位置していたスペースにレンズが収納される事でカメラ未使用時に小型化される構成のカメラにおいて、該ミラーより被写体側にレンズシャッタ機構を設け、該レンズシャッタ開及び閉方向付勢バネを有さないか、又はシャッタ羽根開方

向付勢バネを有する機構であり、カメラ未使用時に該レンズシャッタのシャッタ羽根を閉状態に保持する閉保持手段を設ける事で上述問題点を回避したものである。

## 【 0 0 1 7 】

【実施例】図 1 は本発明の第 1 の実施例であり、図 1 8 の従来例と主として異なるのは、第 1 にバネ 4 6 がシャッタ羽根 4 1 a, 4 1 b を開方向に付勢している点であり、その為撮影準備状態においてシャッタを開放させる為にシャッタアクチュエータ（シャッタ開閉駆動手段）を駆動させる必要はない。第 2 にブッシュブッシュ式の閉係止レバー 1 1 が、ピン 1 4 まわりに回転可能に設けられている点である。係止レバー 1 1 はバネ 1 2 により矢印 1 5 方向に付勢力を受けており、係止レバーの後端 1 1 a がシャッタ地板 4 2 に立てられたストッパピン 4 8 に接する事で回転止めがなされる。（図 1 では係止レバー後端 1 1 a は未だストッパピン 4 8 に接しておらず、後述する閉係止ピン 1 3 が係止レバーの前端 1 1 b に入り込んで回転止めされている。）又、バネ 1 2 により閉係止レバー 1 1 はシャッタ地板 4 2 に押しつけられているが、弱い力で閉係止レバー前部 1 1 b が光軸方向被写体側に浮く構成になっている。以上の構成において撮影準備状態から撮影のシーケンスを追いつつ閉係止手段の動作説明を行なっていく。

【 0 0 1 8 】撮影準備状態においては、シャッタはバネ 4 6 により開放されており、被写体像を接眼面に導く光路を確保している。次に撮影の為にリリースボタンを押すと、シャッタアクチュエータ 4 3（シャッタ開閉駆動手段）が駆動レバー 4 4 によりシャッタ羽根を閉方向に付勢し、シャッタ羽根はバネ 4 6 に逆らって閉方向に動きはじめる。シャッタ羽根 4 1 a には閉係止ピン 1 3 が設けられており、閉係止ピン 1 3 が閉方向に移動し閉係止レバーの斜面 1 1 c に接するとシャッタアクチュエータ 4 3 の閉方向付勢力により閉係止ピン 1 3 は閉係止レバー 1 1 を矢印 1 5 と反対の方向に回す。そして閉係止ピン 1 3 が閉係止レバー 1 1 の斜面 1 1 c を過ぎると、今迄閉係止ピンにより押され矢印 1 5 と反対に回されていた閉係止レバーは、矢印 1 5 の方向に回転をはじめ、閉係止ピンは閉係止レバーの爪 1 1 d に接する。

【 0 0 1 9 】この時点でシャッタアクチュエータ 4 3 の通電を止めると、シャッタ羽根は開方向に開きはじめるが、閉係止ピン 1 3 がこの開動作と閉係止レバー 1 1 の矢印 1 5 方向の回転動作により閉係止レバー前部の凹部 1 1 e に入り込み、シャッタ羽根の閉状態係止を行なう（図 1）。閉係止レバー 1 1 は閉係止ピン 1 3 が閉係止レバー反り部 1 1 f に接しているため、バネ 1 2 により回転することはない。その後ミラーがアップして被写体像をフィルム面へ導く光路を形成するが、シャッタが閉状態の為露光は行なわれない。次にシャッタアクチュエータ 4 3 が再度シャッタ羽根を閉方向に付勢すると、閉係止ピンは反り部 1 1 f の辺を外れ凹部 1 1 g に入り込

む。シャッタアクチュエータ43の通電を停止すると、シャッタ羽根はバネ46により開方向に開こうとする。反り部11fはその端部が光軸方向被写体側に反っており、閉係止ピン13は開方向に移動する時反り部11fの下に入り込み、閉係止レバー前部11bをシャッタ地板42から浮かせた後、閉係止レバー11より離脱し、シャッタは開放され露光状態になる。係止解除後のシャッタ開動作はシャッタアクチュエータ43による開方向付勢力を用いても良い。その後シャッタアクチュエータ43によりシャッタ羽根を閉方向に付勢してシャッタを閉じ露光を終了させると共に再び閉状態係止を行なう。その後ミラーがダウンしてフィルム面への遮光を行ない、上述の一連の動作で再び閉係止解除を行ない、シャッタを開放して被写体像を接眼面に導く光路を確保する。

【0020】カメラを未使用状態にする時には、不図示の電源スイッチを切るとはじめにシャッタアクチュエータ43がシャッタを閉状態にして閉係止した後ミラーアップして、ミラーダウン時のスペースにレンズが沈胴収納された後電源が切れる。

【0021】カメラを撮影準備状態にする時には、不図示の電源スイッチを入れるとレンズがせり出し、次いでミラーダウンしてフィルム面への遮光を行ない最後にシャッタアクチュエータ43により閉係止解除を行ない被写体像と接眼面の光路を確保する。

【0022】以上の様な構成にすると撮影準備状態においてシャッタアクチュエータ43に常にシャッタを開放させる為の電流を流す必要がなく電池の消耗、発熱の問題も防げる。又閉保持手段が設けられている為にミラーアップしてミラーによる遮光が行なえない時もシャッタがシャッタアクチュエータに電流を流し続ける事無くフィルム面への十分な遮光を行なう。

【0023】更にシャッタを開閉駆動するアクチュエータ自身が閉係止、係止解除を行なう為、カメラがどのような状態で電池が抜かれてもフィルムへの光線漏れは生じない特徴が生まれる。

【0024】図2の(イ)は別の実施例であり、図1で示したプッシュプッシュ式の閉係止レバー11の代りに、球状突出部16aを備えた弾性レバー16が設けられている。弾性レバー16はシャッタ地板42と同一部材で、弾性レバー16と同一形状のスリットを入れることにより、形成されており、つけ根(シャッタ地板42と弾性レバー16の境界部)を基点に球状突出部16aが光軸方向に弾性的に撓む構成になっている。又、シャッタ羽根41aにも孔17が設けられている。

【0025】ここでカメラを撮影準備状態にする為に電源スイッチを入れると、始めにレンズがせり出して次にミラーダウンを行なう。そして図2(イ)の状態にあるシャッタ羽根に、不図示のシャッタアクチュエータが開方向の付勢力を加えると、孔17に嵌合していた球状突

出16aは光軸方向フィルム側に弾性的に退避される。(球状突出16aが孔17周辺部に押され、その光軸方向成分力により弾性レバー16が撓む。)そして孔17を有する羽根41aが球状突出16aを乗り越え、シャッタ羽根はバネ46の力で開放され撮影準備状態(図2(ロ))になる。

【0026】撮影の為にリリースボタンを押すと、シャッタアクチュエータの開方向付勢力によりシャッタ羽根は閉じられ、羽根41aが球状突出16aに接した後も、シャッタアクチュエータがシャッタ羽根を閉方向付勢力を加えていると、シャッタ羽根41aの開方向の力により前述と同様に球状突出16aは光軸方向フィルム側に弾性的に退避して、シャッタ羽根41aは球状突出16aを乗り越えて、孔17が球状突出16aと重なる点で互いに嵌合する。シャッタ羽根はこれ以上開方向に動かない様にストッパピン18で止められる為、この状態で球状突出16aと孔17でシャッタ羽根は閉状態に係止される。その後ミラーアップして、フィルム面への光路を確保した後、シャッタアクチュエータがシャッタ羽根を開方向に付勢して、シャッタ羽根41aの球状突出16aを乗り越えて開動作を行なう。露光後シャッタアクチュエータがシャッタ羽根を閉方向に付勢してシャッタを閉じさせ、孔17と球状突出16aを嵌合させ閉状態係止を行なう。その後ミラーをダウンさせて撮影準備状態に戻る。

【0027】カメラ未使用状態に移行させる時は、電源スイッチを切ると、シャッタアクチュエータがシャッタ羽根を閉方向に付勢し、シャッタ羽根41aが球状突出16aを乗り越え、孔17が球状突出16aと嵌合して閉係止を行なった後、ミラーがアップしてレンズが沈胴収納され終了になる。

【0028】この様な構成にすると、図1のプッシュプッシュ式の閉係止レバーに対して構成が簡単であり、シャッタを開状態にする時に、一旦シャッタアクチュエータがシャッタ羽根を閉方向に付勢させる必要がなく、制御が簡単になるばかりでなく、シャッタ開のタイムラグも少なくなる。

【0029】尚、実際にはシャッタ羽根は極めて薄く、それ自体が光軸方向に弾性的に撓み易い為、弾性レバー16を設けず球状突出16aを直接シャッタ地板42に取付け、シャッタ羽根の弾性撓みを利用して球状突出16aを乗り越えても良い。

【0030】図3(イ)は図2を変形した例であり、軸19の先端に弾性部材61を介して係止ピン60が設けられている。そしてシャッタ羽根閉状態にあるときは、図3(イ)の様にシャッタ羽根41aに設けられたストッパ62が係止ピン60より内側に位置し、閉係止を行なっている。この状態でシャッタアクチュエータがシャッタ羽根を開方向に付勢すると、ストッパ62が係止ピン60を矢印63方向に押す。すると弾性部材61が撓

んでストッパ62が係止ピン60より外れ、シャッタ羽根は開状態になる(図3(ロ))。この様な構成にすると、シャッタ羽根自身の光軸方向撓み力は全く加わらない為、羽根の信頼性が高まる。

【0031】図4は別の変形例である。シャッタ羽根41aの端部には磁性体64が取付けられており、シャッタ閉状態ではシャッタ地板42に取付けられた永久磁石65に吸着してシャッタ閉係止を行なっている。そしてシャッタ開状態にする為に、シャッタアクチュエータがシャッタ羽根を開方向に付勢すると、その力で磁性体64と永久磁石65の吸着が外れシャッタ羽根は開放していく。磁石の吸着力は互いの距離の2乗に反比例する為、吸着力はシャッタ開放につれて急激に弱まっていくため、バネ46により開放保持は可能である。この様な構成にすれば、弾性体を介した閉係止では無い為、外乱等にも強く閉状態を係止出来る。

【0032】尚図4において磁性体64は、磁性メッキでもよく、又永久磁石65はシャッタアクチュエータの永久磁石と兼用しても良い。永久磁石65の代りに電磁石(通電で解放、無通電で吸着の構成)を用いても良い。

【0033】以上述べた図1乃至図4の実施例においては、シャッタ羽根はバネ46により開方向に付勢されているが、このバネ46を省き、開放時は微小電流で開保持(従来例では閉付勢バネに逆らって開保持する為開保持電流が大であったが本例ではバネに逆らう必要が無い為開保持電流は小さい)しても良い。この場合シャッタ羽根を閉じる時開保持バネ46に逆らう必要が無い為、その分電池消耗が軽減出来、シャッタアクチュエータも小さく出来る為小型化にも貢献する。

【0034】図5は本発明の第2の実施例であり、第1の実施例と主として以下の点で異なる。

【0035】第1にバネ46がシャッタ羽根を閉方向に付勢しており、第2に球状突出16aを有する弾性レバー16はシャッタ羽根41bの孔17とシャッタ羽根閉状態にて嵌合する構成になっている。又、第3に係止を禁止する禁止手段23が設けられている点にある。

【0036】図5の構成を、作用とともに、カメラシーケンスに沿って説明していく。はじめにカメラ未使用状態においては、シャッタ羽根はバネ46で閉状態に付勢保持されている。次にカメラ撮影準備状態に移行する為に不図示の電源スイッチを入れると、はじめに不図示のレンズがせり出し、次に不図示ミラーがダウンした後、シャッタアクチュエータ(不図示)によりシャッタ羽根はバネ46に逆らって開状態にされ、前述した様にシャッタ羽根41bが球状突出16aを乗り越えて孔17と球状突出16aが嵌合して、シャッタ羽根を開状態に保持する。尚この時の閉係止位置はシャッタ羽根の開口がアパーチャ24の開口径より十分大きくなる様に構成してある。

【0037】そしてシャッタ羽根が開状態になる事で、被写体像と接眼面の光路を確保して撮影者が被写体の確認を行なえるようにする。又このシャッタ羽根閉係止状態においては、シャッタアクチュエータの通電を停止して電池の消耗を防ぐ。

【0038】次に撮影の為にリリーススイッチを入れると、シャッタアクチュエータがシャッタ羽根を閉方向に付勢し、シャッタ羽根41bが球状突出16aを乗り越えて閉係止解除した後、バネ46の作用でシャッタ羽根は閉じる。その後ミラーアップしてフィルム面への遮光を止める。次に禁止手段23が働く。まず、ブランジャ22がオンして禁止バー21が光軸方向被写体側にせり出し、禁止バー21の先端部21aがシャッタ地板42より突出する(図5)。次にシャッタアクチュエータがシャッタ羽根を開状態に付勢して露光を行なうが、この時禁止バー先端部がシャッタ羽根41bと衝突して、シャッタ羽根41bが球状突出16aを乗り越えることがない為、閉係止は行なわれない。尚この禁止バー先端部のシャッタ径方向位置は禁止バー先端部21aがシャッタ羽根41bと衝突する時、シャッタ羽根の開口はアパーチャ開口径と一致する様に設けられている。露光終了迄はシャッタアクチュエータは、シャッタ羽根を開方向に付勢しており、露光終了後シャッタアクチュエータによりシャッタ羽根を閉方向付勢してシャッタを閉じ(バネ46でシャッタ羽根を閉じてよい)、ブランジャ22の電源を切り、バネ25の力で禁止バーの先端部21aをシャッタ地板42より退避させる。次いでミラーダウンして撮影準備状態に戻る。

【0039】ここで禁止手段23を設けたのは、露光毎にシャッタ羽根閉係止、解除を行なっていると高速シャッタが得られないからであり、高速シャッタが必要な時のみ禁止手段を用いてもよい。その場合低速シャッタにおいては、シャッタアクチュエータにてシャッタ羽根を開方向に付勢し続ける必要が無い為省電力化が図れる。

【0040】撮影準備状態からカメラ未使用に移行する時は、電源スイッチを切ると、シャッタアクチュエータがシャッタ羽根を閉方向に付勢してシャッタ羽根41bが球状突出16aを乗り越え閉係止解除が行なわれた後、バネ46の力でシャッタ羽根は閉状態になる。その後ミラーアップしてレンズが沈胴収納してカメラ未使用状態になる。

【0041】この様な構成にすると、カメラ未使用時にはシャッタ羽根が閉状態に付勢されている為、外乱等でシャッタ羽根が開放状態を続けることがなく、信頼性の有る遮光が行なえる。

【0042】図6は別の変形例であり、禁止手段の駆動源であるブランジャ22が廃止され、替わりにミラー26の駆動源を禁止手段に用いている。

【0043】図6において、カメラ未使用時及び撮影時の様にミラーアップ状態にある時は、ミラーモータ29

により回転されるミラー駆動ギア27に立てられたピン28が禁止バー21の端部21bを押しており(図6はカメラ未使用状態の図)、禁止バー先端部21aがシャッタ地板42より突出して、シャッタの閉係止を禁止している。その為露光時に閉係止が行なわれて高速シャッタが切れなくなる事はない。

【0044】カメラ撮影準備状態においては、ミラーがミラーダウンしている為、ピン28は破線で示す28'に位置している。その為禁止バー21は、バネ25によりその先端部21aがシャッタ地板42より退避している。その為撮影準備状態においては、シャッタ羽根の開閉係止が行なえる。

【0045】以上の構成にすると禁止手段の為に別に電磁手段を設ける必要が無く、その分小型、軽量化される。

【0046】図7は本発明の第3の実施例であり、閉係止手段と閉係止手段が設けられ、シャッタ羽根の開方向或いは開方向付勢のバネが省かれている点が既述の例とは異なる。

【0047】図7と図5を比べてみると、シャッタ閉方向付勢バネが省かれ、代りに閉係止用の球状突出16aが設けられている。

【0048】動作はシャッタアクチュエータの付勢力により閉係止解除、開係止、開係止解除、閉係止を行なう点、及び撮影時において、開係止禁止手段を働かせる点も今迄の例同様である。しかし図7の様に開、閉ともに係止手段を設けると開方向、閉方向の付勢バネが必要なくなる。シャッタ羽根はシャッタアクチュエータで開閉駆動させる訳であるが、前述の様にバネが無い為、温度等によりバネ定数が変化し、シャッタ開閉時の立上りスピードにムラが生ずる事なく精度の高い露光が行なえ、又、バネに逆らってシャッタを駆動し続ける必要がなくなる為省電力化も図れる。

【0049】図8は同様な条件を図6の構造を基に実現した例であり、動作等は上述及び図6と同様な為、重複は避けるが、やはりシャッタ開、閉付勢バネが無く、更に禁止手段のブランジャも無い為より省電力化される。

【0050】図9(イ)は図8の開、閉係止手段としてバネ31を用いた例であり、バネ31はシャッタ羽根閉付近においてはレバー31がシャッタ羽根41aに設けられたピン34をシャッタ羽根41aの回転軸45aよりも内側で押している(図9(イ))為、閉方向に付勢力を発生している。又、シャッタ羽根開状態付近においては、レバー31aがピン34を軸45aより外側で押している(図9(ハ))為、開方向に付勢力を発生している。そのため、このバネ31が開、閉係止手段となっている。又、シャッタ羽根の移動状態においては、図9(ロ)に示す通り、レバー31aがピン34を軸45aと結ぶ線分上に付勢する為、閉、開のバネ力は極めて少なくなる。

【0051】その為図8の例と同様に省電力化が可能であり、構造も簡略化出来る。

【0052】以上説明した各実施例によれば、シャッタ開、閉係止手段を設けた事で従来、アクチュエータで開保持を行なっていたシャッタに比べ大巾な省電力化が図れ、カメラ未使用時におけるフィルム面への遮光が確実に行なえる。又、シャッタアクチュエータが開閉の係止、係止解除を行なう為、他の専用の駆動手段により係止、係止解除を行なう場合と比べ小型、軽量化が可能となる。

【0053】図10は本発明の実施例であり、図18の従来のレンズシャッタと同機能の部材は同部番で表わす。

【0054】図10が図18の従来例と主として異なるのは、バネ146がシャッタ羽根41a、41bを開方向に付勢している点である。そしてシャッタ羽根41aには係止ピン113が設けられている。係止手段116はその拡大図が図11(イ)に示される様に係止レバー112と係止レバー112を矢印128方向に付勢するバネ114、及び係止レバー112に設けられた駆動ピン112bに掛けられた、ワイヤ状の形状記憶合金部材111の矢印129方向の張力の釣合った状態で停止している。ワイヤ状の形状記憶合金部材111はその両端をネジ123、124でカメラ本体に締め付け固定しており、ネジ124で固定してある端は接地されている。変向ピン121、122はワイヤ状形状記憶合金部材の延出方向を変更させる役目を行ない、これにより小さなスペースでワイヤ状形状記憶合金部材の長さを長く出来、熱による復元の前後での伸びストロークを大きくしている。

【0055】以上の様な構成において撮影終了後、カメラ未使用状態に移行する作動について説明する。

【0056】はじめに電源スイッチをオフにすると、シャッタ羽根駆動手段によりシャッタ羽根はバネ146に逆らって閉方向に駆動される。そして閉直前に係止ピン113が矢印150の軌跡で係止ピン112の先端112aに衝突する。すると係止ピン先端部112aにはテーパー部112cが設けてある為、係止レバー112は係止ピン113の力で矢印151の方向にバネ114に逆らって押し上げられ、係止ピン113が係止レバー先端部112aを過ぎると係止レバー112はバネ114により元の位置に復帰する。次にシャッタ羽根駆動手段による閉方向駆動を止めると、シャッタ羽根41a、41bはバネ146により開方向に付勢されるが係止レバー112の係止爪112dに係止され閉係止される。その後、ミラーアップして、ミラーダウン時ミラーが位置していたスペースにレンズが沈胴収納されカメラ未使用状態になる。

【0057】カメラを撮影準備状態にするときは、はじめに電源スイッチを入れるとレンズがせり出し、次にミ

ラードダウンする。その後形状記憶合金部材 1 1 1 の一端 (ネジ 1 2 3 に固定されている側に電圧を加え形状記憶合金部材 1 1 1 内に電流を流し熱を与える。形状記憶合金部材 1 1 1 はバネ 1 1 4 により伸方向に変形させられているが、熱を加える事で復元して縮む。すると係止レバー 1 1 2 はバネ 1 1 4 に逆らって矢印 1 2 1 方向に移動し、係止ピン 1 1 3 が係止爪 1 1 2 d より外れ、シャッタ羽根 4 1 a, 4 1 b はバネ 1 4 6 により開状態になり、撮影準備状態になる。そして形状記憶合金部材 1 1 1 への通電を停止すると形状記憶合金部材 1 1 1 が冷却されると共にバネ 1 1 4 の力で係止レバー 1 1 2 は元の位置に復帰する。

【0058】撮影時にはリリースボタンを押すとはじめにシャッタ羽根がシャッタ羽根駆動手段で閉じられ係止される。次にミラーがアップし、形状記憶合金部材に通電して係止解除を行ないシャッタ羽根を開閉してフィルムへの露光を行なう。そしてシャッタ羽根駆動手段でシャッタ羽根を付勢した状態でミラーをダウンし、その後シャッタ羽根駆動手段への通電を停止しシャッタ羽根をバネ 1 4 6 により開放させる。

【0059】ここで露光後シャッタ羽根をシャッタ羽根駆動手段で閉方向に付勢しておくのは、この段階では形状記憶合金部材 1 1 1 が十分冷めておらず係止レバー 1 1 2 によりシャッタ羽根を閉係止出来ないからである。

【0060】同様の事はカメラ未使用状態にもあり、露光直後、或いは撮影準備状態にした直後等形状記憶合金部材による係止解除直後にカメラ未使用状態による時には形状記憶合金部材が十分に冷めていない為、カメラの電源を切ってもしばらく (1~2 秒) はカメラ未使用状態へ移行しない、或いはカメラ未使用状態になってもしばらくシャッタ羽根駆動手段がシャッタ羽根を閉方向に付勢しておく構成になっている。

【0061】又形状記憶合金部材 1 1 1 ワイヤの線長をかせぐ為、その延出方向を変更するピン 1 2 1, 1 2 2 には、図 1 1 (ロ) に示す様な案内手段としての溝 1 2 5 a, 1 2 5 b が設けられ、この溝 1 2 5 a, 1 2 5 b に形状記憶合金ワイヤ部材 1 1 1 が入る構成であり、互いのワイヤが接触導通して電流が短絡しない構成になっている。尚、案内手段は図 1 1 (ハ) に示される様に案内孔 1 2 6 a, 1 2 6 b としても良い。

【0062】又、形状記憶合金部材 1 1 1 は曲げにくく、又、熱により復元してしまう為、それを防ぐ為に案内手段として図 1 1 (ニ) に示すピン 1 2 1, 1 2 2 の周囲を被うカバー 1 2 7 を設けて形状記憶合金部材 1 1 1 の曲げ部が緩み、広がるのを防いでも良い。

【0063】上記の実施例においてはシャッタ羽根駆動手段と係止駆動手段 (形状記憶合金部材) を別々に駆動しており、各々に指令して通電する分、シーケンスがやっかいであったが、図 1 2 に示す様に、シャッタ羽根駆動手段のコイル 1 4 3 a と形状記憶合金部材をダイオー

ド (半導体素子) 1 3 1 a を介して直列接続させ、又、この接続部コイル 1 4 3 a 側の端をダイオード 1 3 1 b を介して接地させる構造にすると、シャッタ羽根駆動手段と係止駆動手段が一連の動作で終了する為、シーケンスが極めて簡素化される。

【0064】図 1 2 において、シャッタ羽根を閉める時は、電流は矢印 1 3 2 に示す  $i_s$  の様に流れ、半導体 1 3 1 a により形状記憶合金部材には電流は流れない。その為前述と同様に、係止ピン 1 1 3 が係止爪 1 1 2 d に掛かり閉係止される。次にシャッタ羽根を開ける時は電流は矢印 1 3 3 に示す  $i_o$  の様に流れる為、形状記憶合金部材が熱せられ、係止解除を行ない、シャッタ羽根駆動手段とバネ 1 4 6 の力でシャッタ羽根は開放させられる。

【0065】尚この場合シャッタ開時と閉時では、シャッタ開時の方が通電部の抵抗総和が大きく、その分シャッタ羽根開方向駆動力はシャッタ羽根閉方向駆動力より小さくなるが、バネ 1 4 6 がシャッタ羽根を開方向に付勢している為、開閉の駆動力の差はバネ 1 4 6 のバネ力で補われる。

【0066】以上の例においては形状記憶合金部材は一方方向記憶方式で、バネ力 (バネ 1 1 4) で張力を与えていたが、別にこれに限定されることは無く、バネ 1 1 4 を廃し、2 方向記憶の形状記憶合金部材を用い冷却時係止、通電係止解除を行なわせても良いのは云う迄もない。

【0067】本例の様に形状記憶合金部材を用いて係止手段の駆動を行なわせると、他の手段 (プランジャ等) で駆動する方式と比べ極めてコンパクトで軽量のシャッタ羽根保持装置が構成出来る。

【0068】以上説明したように形状記憶合金部材を用いて係止手段の駆動を行なわせると、他の方式 (プランジャ等) で駆動するのに比べて、極めてコンパクトで軽量のシャッタ保持装置が構成出来る。

【0069】又、形状記憶合金部材の延出方向を変更するピンを設ける事で、小さなスペースで形状記憶合金部材線長を長く出来、熱による復元ストロークを長くとり、係止解除が確実にこなえる効果がある。

【0070】更にシャッタ羽根駆動手段コイルと形状記憶合金部材を半導体を介して直列接続する場合は、シャッタ羽根を開方向させる為にシャッタ羽根駆動手段コイルに通電すると、自動的に閉係止が解除される為、特別な閉係止解除命令が必要無く、構成が簡単に出来る。

【0071】図 1 3 は本発明の第 5 実施例であり、図 1 8 と同機能の部材は同部番で表わし説明は省略する。図 1 3 においてシャッタ羽根 4 1 b には開方向付勢バネ 2 4 6 が設けられており、撮影準備状態においてはシャッタ羽根は開放状態になっている。そのため撮影準備中はシャッタアクチュエータコイルに開方向付勢電流を流す必要はない。次に撮影時は、シャッタアクチュエータ



(図13には不図示) がバネ246に逆らってシャッタ羽根41a, 41bを閉状態にさせ、次に撮影準備中にフィルム面212に光が入り込むのを防いでいたミラー211がハネ上がりミラーアップ状態になる。それからシャッタアクチュエータに逆通電してシャッタ羽根を開放し、フィルム露光後再びアクチュエータに通電してシャッタ羽根を閉じ露光を完了させる。次にミラーダウンでフィルム面212への遮光を行なうとともに、被写体像と接眼面間の光路を確保した後、アクチュエータへの通電を終了させてバネ246の力によりシャッタ羽根41a, 41bを開放状態にして、接眼面を通して被写体が見える様にする。

【0072】撮影完了後カメラを未使用状態にする時は、はじめに電源スイッチ213を矢印214の方向にスライドさせると電源スイッチ上面に設けられたインピダンス変化等を利用したスイッチ215により、スイッチに指が触れた事を検知してシャッタアクチュエータがシャッタ羽根41a, 41bを閉状態にする。更に電源スイッチをスライドさせると電源スイッチ213と一体の付勢板216が保持レバー217の端部217aを押し保持レバー217の先端217bがレンズシャッタの地板42の前面より突出してシャッタ羽根が閉状態になるのを防ぐ(シャッタ羽根を閉状態に係止する)。そして電源スイッチから指が離れると、シャッタアクチュエータへの通電は切れるが保持レバー217によりシャッタは閉状態に保たれる。次にミラー211がミラー駆動モータ218の回転力によりミラーアップし、レンズがミラーダウンの位置に収納され全電源はオフされる。尚保持レバー217の端部217aには弾性部217cが設けられており、電源スイッチ213を急激に矢印214方向にスライドさせても保持レバー217が応答しない構造になっている。

【0073】次に撮影準備状態にする為に電源スイッチ213を矢印214と反対方向にスライドさせると、全電源が入り、レンズがせり出し、ミラー駆動モータ218の逆回転によりミラー駆動ピン260がミラー211から離れていくと、バネ219の力によりミラー211はミラーダウン状態になる(図13はこの状態を示している)。しかし保持レバー217はその切り欠き217d'にストッパ261が入り込んでおりシャッタ閉保持状態を維持している。ストッパ261はストッパ支持軸262まわりに回転可能に支持され、バネ263により矢印264まわりに付勢されている為、切り欠き217dより抜ける事はない。次にミラー駆動ピンがミラーダウン終了後も更に回り続け、解除レバー265の端部265aを押す。解除レバー265は、解除レバー支持軸266まわりに回転可能に支持されている為、その1端部265aが押されると、相対的に他の端部265bがせり上り、ストッパ261の端部261aを押し、ストッパ261を切り欠き217dより離脱させる。解除レ

バー265はバネ267により矢印268方向に付勢されている為ミラー駆動ピン260が解除レバー端部265aを押さない限り、ストッパ261の端部261aを押し上げる事はない。ストッパ261が切り欠き217dから退避すると、保持レバー217に設けられ保持レバー217を矢印269に付勢するバネ270の作用により保持レバーは地板42より後退しシャッタ羽根の閉方向保持が終了し、バネ46の作用でシャッタ羽根は開状態になる。

【0074】以上の様な構成にすると、撮影準備状態において、シャッタ羽根を開状態にする為に、シャッタアクチュエータに常に通電しておく必要がなく、上述問題点は無く、又、カメラ未使用時においてはシャッタが閉保持される為光線漏れは生じない。

【0075】尚本例においてカメラ未使用時から撮影準備状態に移る時、電源スイッチに連動して保持レバー17が退避しない構成としたのは、以下に述べる理由による。

【0076】カメラ未使用状態から撮影状態に移行するとき、はじめに電源スイッチを入れるとシャッタアクチュエータがシャッタ羽根を閉状態に付勢し始め、次にレンズがせり出し、ミラーダウン後シャッタアクチュエータ通電停止でシャッタを開かせる構成にしても目的は達せられ、この時は保持レバーの突出、退避とも電源スイッチ連動にして良い為、構造は極めてシンプルに出来る。しかし電源スイッチを入れ、ミラーが完全にミラーダウンしない内に電池が抜かれた場合、ミラーによるフィルム面への遮光は望めず、又シャッタもバネ246により開状態になってしまいフィルムが露光してしまう、そのため保持レバーの退避はミラーが完全にミラーダウンした後行なう構成にしている。図13において保持レバー217の先端部217bは弾性部271を介して保持レバー217に取付けられる様な構成にすると、先端部はシャッタ羽根を閉保持する時に矢印272方向に撓んで保持する為、保持状態において弾性保持(シャッタ羽根を閉状態に付勢する)される為、保持にガタが無くなる。

【0077】尚以上の説明において、電源スイッチ213を触れる事でシャッタアクチュエータがシャッタを閉じさせる構成としたが、電源スイッチの動作に連動するスイッチ手段であれば、上記に限られるものではない。

【0078】又、本発明においてシャッタ機構には開方向付勢バネが設けられていたが、このバネも廃止して撮影準備状態には微小電流でシャッタ羽根を開保持しておいても良い(バネが無い場合シャッタ羽根は極めて小さい力で駆動出来る)。この場合シャッタ閉動作時(カメラ未使用に移行する時、露光の為ミラーアップ直前にシャッタを閉じる時等)にシャッタアクチュエータがバネに逆らって羽根を閉状態にする必要がない為、省電力化できるばかりでなく、シャッタアクチュエータそのものの

も小型化出来る利点が生ずる。

【0079】図14は本発明の別の変形物である。図14において、保持レバー217は長孔217dを有しており、伝達バー273と長孔217dが嵌合し、保持レバー217が伝達バー273上を摺動できる様な構成になっている。又、保持レバー217はシャッタ地板42から突出した爪274に押さえられており、シャッタ地板から離脱する事はない。伝達バー273にはカム275が設けられており、電源スイッチ213を切ると電源スイッチ213に設けられた端部277（電源スイッチ213とは弾性体276を介して結合される。）が、カム275の端部275aを押し、伝達バー273が回転して保持レバー217を回し、シャッタをロック状態にする。次に電源スイッチ213を再び入れてもカム275の凹部275bがストッパ261に係止され、図13と同様に伝達バー273は回転しない。そしてモータ218の作用でミラーダウン状態になり、更にモータ218が回転してミラー駆動ピン260が解除レバー265の端部265aを引き上げると別の端部265bがストッパ261をバネ263に逆らって矢印264まわりに回転させ、カムの凹部275bのストッパ261による係止を解除する。カム275はバネ270により矢印269回りに付勢を受けている為、ストッパ261が外れると伝達バー273は矢印269回りに回転し保持レバー217によるシャッタ羽根閉状態保持を解除させる。

【0080】以上述べた様に図14の構成は、図13に対して主として伝達バー273上を保持レバー217が摺動出来る点が異なる。

【0081】この様な構成にするとシャッタ機構が光軸方向に移動（AF、ズームや前述の様なカメラ未使用時のレンズ収納によりシャッタ機構が光軸方向に移動する事は生じ得る。）しても、シャッタ羽根の閉保持、解除は確実に行なえる。

【0082】図15は本発明の第6の実施例であり、レンズを保持するレンズ鏡筒に設けられたカム形状によりシャッタ羽根の保持、解除を行なうことができる。

【0083】図15において、レンズ鏡筒222はモータ221により回転し、その作用によりカメラ未使用時のレンズ沈胴収納及び撮影準備状態に移行した時のレンズせり出しを行なう。又、レンズ鏡筒には保持レバー217へ力を伝える伝達カム223が切られており、保持レバー217の端部のフオロア217aが嵌合している。そしてカメラ未使用時にはじめにシャッタ羽根41a、41bがシャッタアクチュエータにより閉じられ、次にレンズを沈胴収納する為に鏡筒222が矢印224方向に回転すると、伝達カム223上の保持レバー端部217aは伝達カム223の斜行部223bを通り平行部223cに至る。その為保持レバー217は、光軸方向前側に押され、保持レバー先端部217bがシャッタ地板42より突出してシャッタ羽根41a、41bの閉

保持を行なう。

【0084】撮影準備状態に移行する時は、はじめにアクチュエータがシャッタ羽根41a、41bを閉状態に付勢保持し、次にレンズをせり出す為に鏡筒222が矢印224と反対の方向に回転し、保持レバー端部217aは伝達カム223上を、223c→223b→223aに至り、保持レバー217は光軸後側に引かれ、シャッタ地板より保持レバー先端部217bが退避して閉保持状態を解除する。そしてシャッタアクチュエータの通電を停止しバネ246によりシャッタは開状態になる。

【0085】以上の構成にすると構造が極めて簡単になり、軽量化、小型化が促進される利点がある。

【0086】図16は本発明の第7の実施例であり、ミラー駆動手段に連動してシャッタ羽根閉保持を行なうものである。

【0087】図16はカメラ未使用状態を示しており、不図示の電源スイッチによりカメラ撮影準備状態に移行するとシャッタアクチュエータがシャッタ羽根を閉方向に保持付勢し、レンズがせり出し、次にモータ218によりミラー駆動ギヤ232が矢印233方向に回転し、ミラー駆動ピン260が、バネ219でミラーアップ状態に付勢されるミラー211を押し、ミラーダウン状態にする。そしてそれと同時に解除ピン260aが保持レバー217をバネ270に逆らって押し保持レバー先端部217bがシャッタ地板42より退避して、シャッタ羽根閉保持解除を行なう。次にシャッタアクチュエータによるシャッタ羽根閉方向付勢が解除し、バネ246によりシャッタ羽根開状態になり、被写体像が接眼面を通して確認出来る様になる。

【0088】撮影を行なう時リリースボタンを押すと、シャッタアクチュエータがシャッタ羽根を閉状態に付勢保持し（図17（イ））、次にモータ218が回転しミラー駆動ギヤ232が矢印233と逆方向に回転し、ミラー駆動ピン260が退避すると、バネ219の作用でミラーアップが行なわれ、ミラーはストッパ231a、231bに当接して停止する（図17（ロ））。この状態ではシャッタ羽根は保持レバー217で閉保持される為、シャッタの開閉は行なえず、露光は出来ない。ミラー駆動ギヤ232は更に回転して解除ピン260aが保持レバー217の端部217aをバネ270に逆らって押し、保持レバー先端部217bをシャッタ地板42から退避させ閉保持解除を行なう（図17（ハ））。次にシャッタアクチュエータによりシャッタ羽根開閉を行ないフィルムへの露光を行なう。その後シャッタアクチュエータによりシャッタ羽根閉方向付勢保持を行ない、ミラー駆動ギヤ232が矢印233方向に回転しミラーダウンを行なう。そしてシャッタアクチュエータによるシャッタ羽根閉方向付勢を解除し、バネ246によりシャッタを開状態にして撮影準備状態に戻る。

【0089】カメラ未使用時に移行する為に電源スイッ

チを切ると、シャッタアクチュエータがシャッタ羽根を閉状態に付勢保持し、次にミラー駆動ギア 2 3 2 が矢印 2 3 3 と反対方向に回転し解除ピン 2 6 0 a が保持レバー一端部を押して、保持レバー先端部がシャッタ羽根を閉状態保持する。そしてミラーアップとともにミラーによる遮光が行なわなくなり、ミラーの退避されたスペースにレンズが収納され、シャッタアクチュエータへの通電が停止され一連の動作が終了する。

【0090】以上の様に閉保持手段がフィルムへの遮光を行なうミラー部と連動している為、ミラーの駆動とシャッタの閉保持、解除の連動をうまく行ない、遮光を確実にに行なうことができる。

【0091】以上説明した第 5 ～ 7 実施例によれば、カメラ未使用時にシャッタ羽根を閉状態に閉保持する手段を設けた事によりカメラ未使用時におけるフィルム面への遮光が確実に行なえ、この保持手段は電源スイッチ、レンズ沈胴、ミラーと機械的に連動する構成となっている為電源外乱（電池消耗、電池取外し）に無関係な確実な遮光が行なえる。

【0092】

【発明の効果】以上説明したように、本発明によれば、シャッタ羽根開閉駆動手段により駆動されるシャッタ羽根を有し、該シャッタ羽根により被写体像の光路の開閉を行なうカメラ用シャッタ装置において、シャッタ羽根を閉状態及び／又は開状態に係止する係止手段を有し、シャッタ羽根開閉駆動手段により係止手段の係止や係止解除を行なわしめるようにしたので、撮影準備状態等におけるシャッタアクチュエータコイルの消費電力を低減したり、その変形を防止することができる。

【図面の簡単な説明】

【図 1】本発明の第 1 の実施例を示す斜視図。

【図 2】図 1 に示す実施例の変形例を示す斜視図。

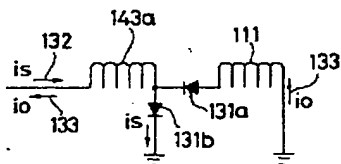
【図 3】図 1 に示す実施例の他の変形例を示す斜視図。

【図 4】図 1 に示す実施例の更に他の変形例を示す斜視図。

【図 5】本発明の第 2 の実施例を示す斜視図。

【図 12】

図 12



【図 6】図 5 に示す実施例の変形例を示す斜視図。

【図 7】本発明の第 3 の実施例を示す斜視図。

【図 8】図 7 に示す実施例の変形例を示す斜視図。

【図 9】図 7 に示す実施例の他の変形例を示す斜視図。

【図 10】本発明の第 4 の実施例を示す斜視図。

【図 11】本発明の第 4 の実施例における要部の拡大斜視図。

【図 12】本発明の第 4 の実施例に使用される回路の変形例を示す図。

10 【図 13】本発明の第 5 の実施例を示す斜視図。

【図 14】本発明の第 5 の実施例の変形例を示す斜視図。

【図 15】本発明の第 6 の実施例を示す斜視図。

【図 16】本発明の第 7 の実施例を示す斜視図。

【図 17】本発明の第 7 の実施例の作動を説明する図。

【図 18】従来のシャッタ機構の斜視図。

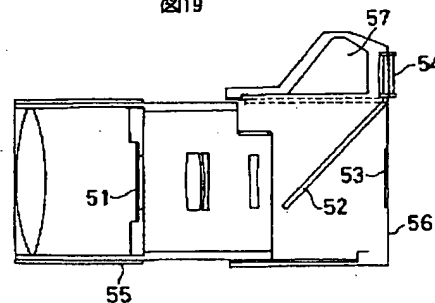
【図 19】従来の沈胴式カメラの断面図。

【符号の説明】

1 1…閉係止レバー	1 6…弾性レバー
1 6 a…球状突出	1 9…軸
2 1…禁止バー	2 2…ブランジャ
2 3…係止禁止手段	4 1 a, 4 1 b…シャッタ羽根
4 3…シャッタアクチュエータ	6 0…係止ピン
6 1…弾性部材	6 4…磁性部材
6 5…永久磁石	1 1 1…形状記憶合金部材
1 1 2…係止レバー	1 1 3…係止ピン
1 2 1, 1 2 2…延出方向変更ピン	
1 2 5 a, 1 2 5 b, 1 2 6 a, 1 2 6 b, 1 2 7…案内手段	
2 1 3…電源スイッチ	2 1 7…保持レバー
2 6 0…ミラー駆動ピン	2 6 1…ストッパ
2 6 5…解除レバー	

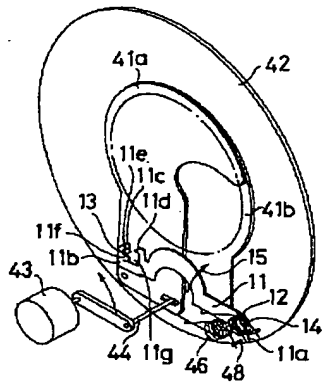
【図 19】

図 19



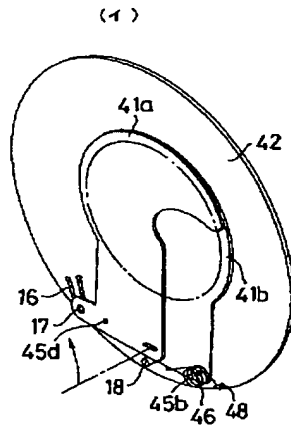
【図 1】

図 1

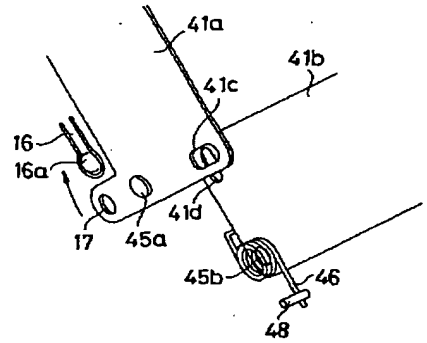


【図 2】

図 2

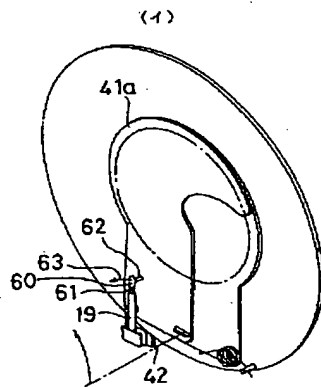


(a)



【図 3】

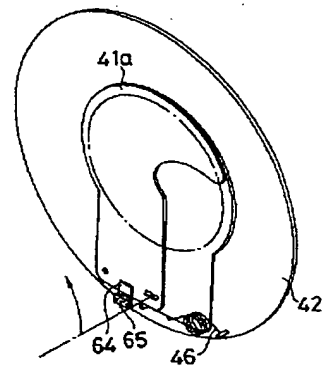
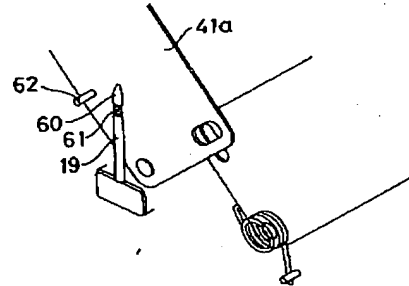
図 3



【図 4】

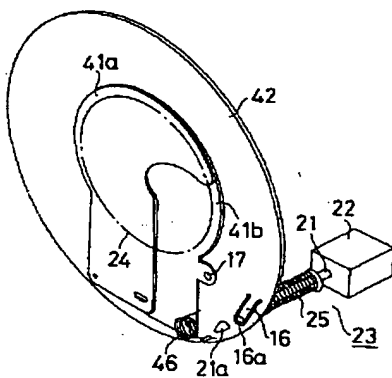
図 4

(a)



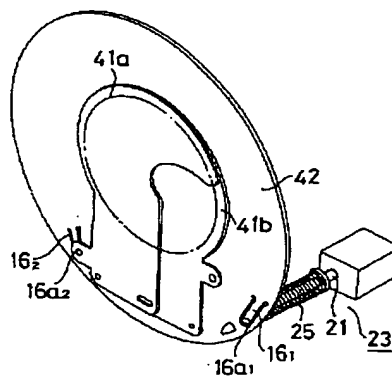
【図 5】

図 5



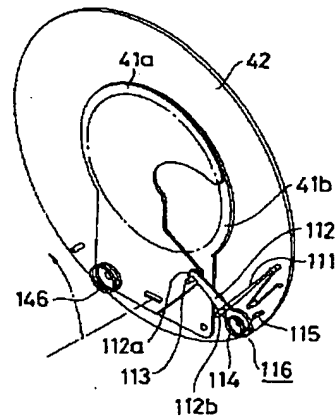
【図 7】

図 7

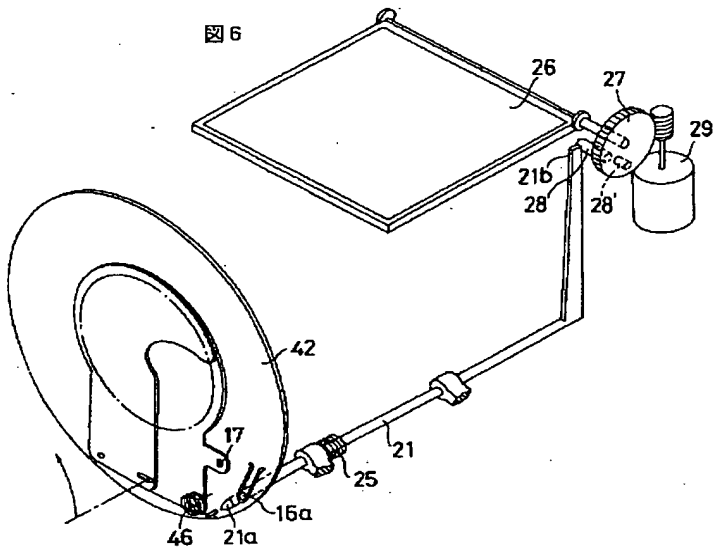


【図 10】

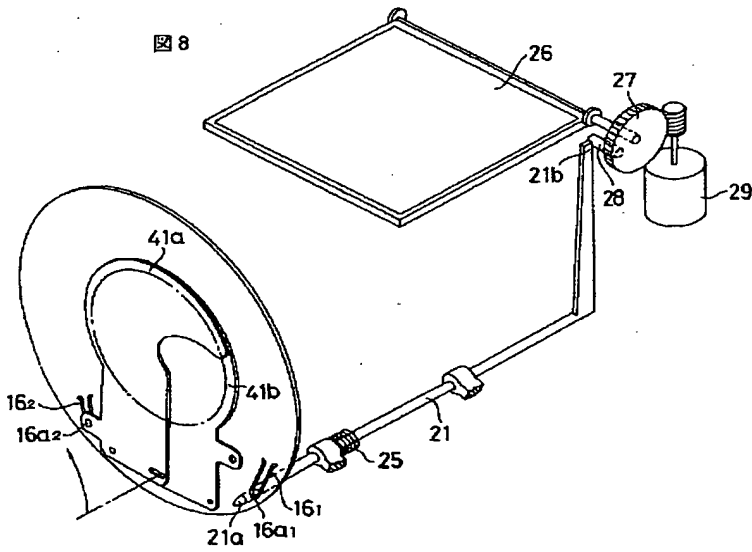
図 10



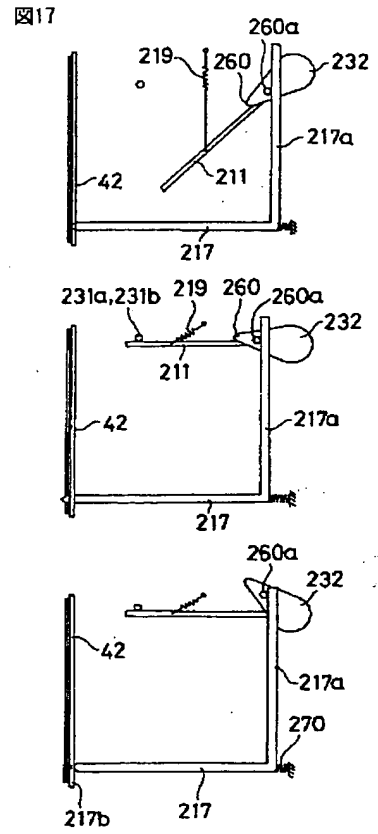
【図 6】



【図 8】

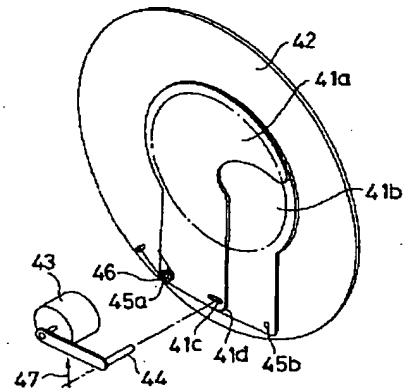


【図 17】

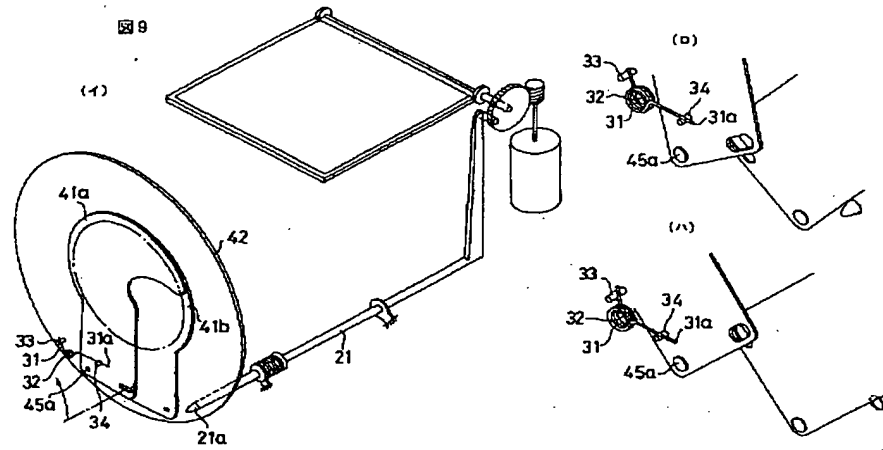


【図 18】

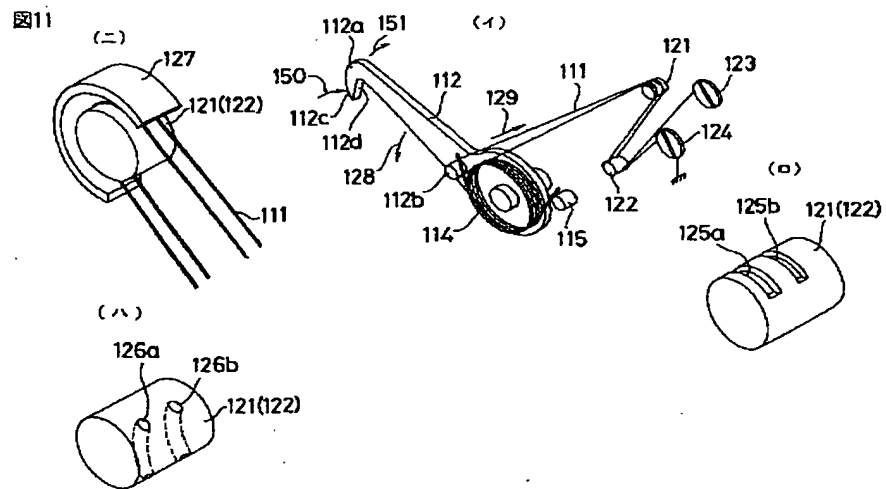
図 18



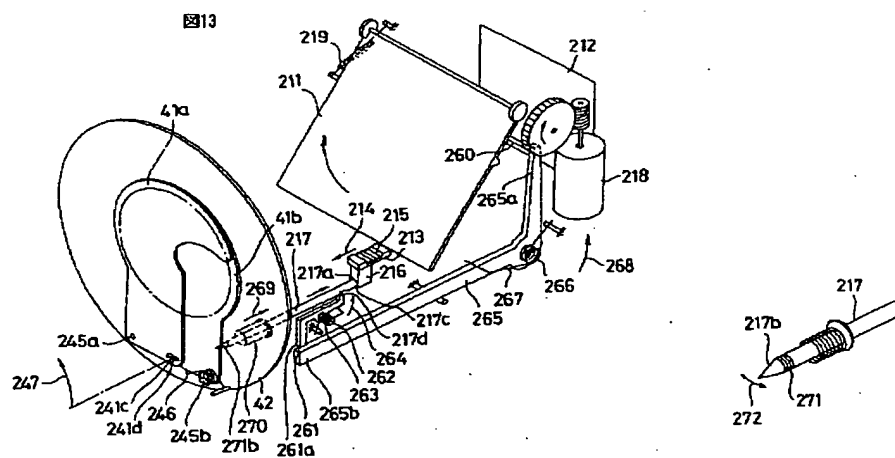
【図 9】



【図 11】



【図 13】



【図 14】

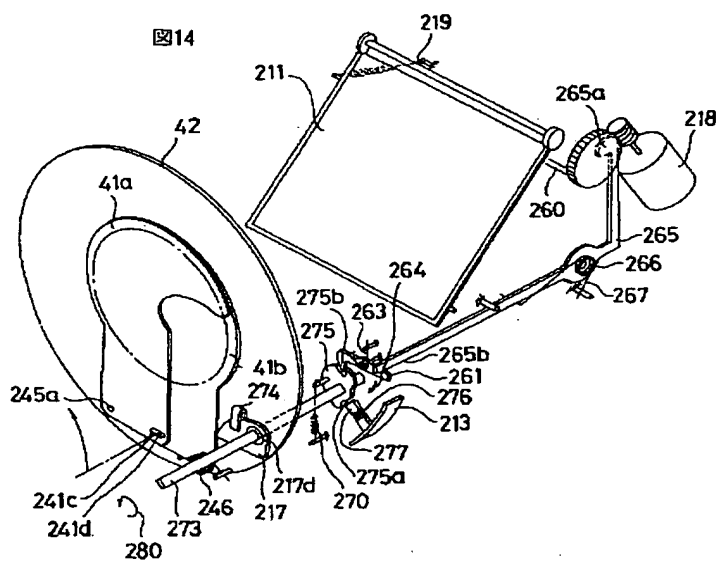


图15

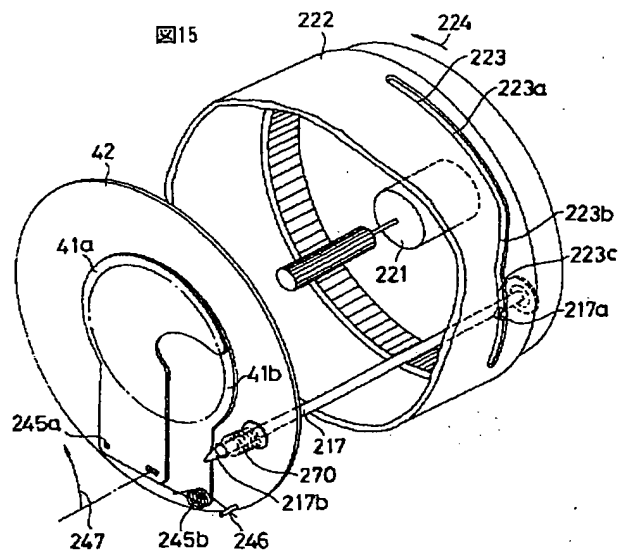
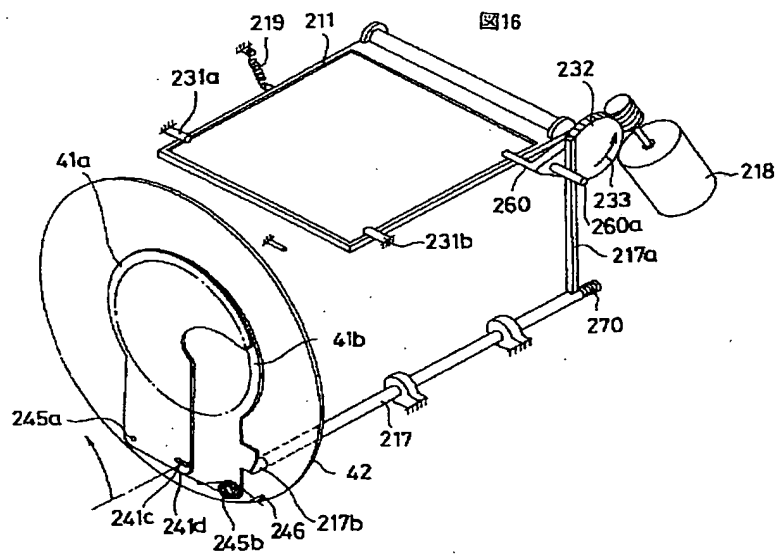


图16





*Date: April 5, 2005*

*Declaration*

*I, Michihiko Matsuba, President of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chome, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation of the copy of Japanese Unexamined Patent No. Hei-5-313226 laid open on November 26, 1993.*

A handwritten signature in black ink, appearing to read 'm. matsuba', with a stylized flourish at the end.

*Michihiko Matsuba*

*Fukuyama Sangyo Honyaku Center, Ltd.*

SHUTTER APPARATUS FOR CAMERA

Japanese Unexamined Patent No. Hei-5-313226

Laid-open on: November 26, 1993

Application No. Hei-4-120604

Filed on: May 13, 1992

Inventor: Koichi WASHISU

Applicant: Canon Corporation

Patent Attorney: Kohira HONDA, et al.

#### SPECIFICATION

[TITLE OF THE INVENTION] SHUTTER APPARATUS FOR CAMERA

[Abstract]

[Object] To reduce consumption current in a shutter actuator coil in a photographing ready state and the like, so as to achieve power savings and avoid thermal deformation in the actuator coil.

[Construction] In a shutter apparatus for a camera provided with a shutter blade driven by shutter blade opening and closing driving means so that the shutter blade opens and closes an optical path of an object image, locking means for locking the shutter blade in a closed state and/or an opened state is provided so that the shutter blade opening and closing driving means

performs lock and lock releasing of the locking means.

[WHAT IS CLAIMED IS;]

[Claim 1] A shutter apparatus for a camera provided with a shutter blade driven by shutter blade opening and closing driving means so that the shutter blade opens and closes an optical path of an object image, the apparatus comprising closed locking means provided with a first locking member provided in a stationary portion and a second locking member provided in the shutter blade so as to lock the shutter blade in a closed state, wherein lock and lock releasing of the closed locking means are performed by the shutter blade opening and closing driving means.

[Claim 2] A shutter apparatus for a camera according to Claim 1, wherein the closed locking means is push-push type locking means for performing a closed state lock in response to a closing direction biasing force exerted by the shutter blade opening and closing driving means of the shutter blade and then performing closed state lock releasing in response to a closing direction biasing force exerted again, and wherein during the time that the shutter blade is in the closed state lock, the shutter blade opening and closing driving means exerts a closing direction biasing force to the shutter blade, and then performs shutter blade opening direction drive.

[Claim 3] A shutter apparatus for a camera according to Claim

1, wherein the closed locking means is elastic locking means for moving beyond an elastic member and thereby performing a lock in response to a closing direction biasing force exerted by the shutter blade opening and closing driving means of the shutter blade, and then moving again beyond the elastic member and thereby performing lock releasing in response to a locked opening direction biasing force.

[Claim 4] A shutter apparatus for a camera according to Claim 1, wherein the closed locking means is magnetic locking means for performing attraction lock in response to a closing direction biasing force exerted by the shutter blade driving means of the shutter blade and then performing attraction separation and lock releasing in response to an opening direction biasing force.

[Claim 5] A shutter apparatus for a camera provided with opened locking means for locking a shutter blade in an opened state, wherein shutter blade opening and closing driving means performs lock and lock releasing of the shutter blade and the opened locking means.

[Claim 6] A shutter apparatus for a camera provided with closed locking means for locking a shutter blade in a closed state and opened locking means for holding the shutter blade in an opened state, wherein shutter blade opening and closing driving

means performs lock and lock releasing of the shutter blade, the closed locking means, and the opened locking means.

[Claim 7] A shutter apparatus for a camera according to Claim 5 or 6, comprising inhibiting means for inhibiting the opened state lock of the shutter blade performed by the opened locking means at the time of exposure.

[Claim 8] A shutter apparatus for a camera according to Claim 7, wherein the inhibiting means is mechanically linked with mirror means for switching from one to another between an optical path for leading an object image to an ocular plane and an optical path for leading the object image to a film plane, whereby the inhibiting means inhibits the opened lock of the shutter blade performed by the opened locking means, in states other than a mirror state that the mirror means forms the optical path for leading the object image to the ocular plane.

[Claim 9] A shutter apparatus for a camera provided with a shutter blade driven by shutter blade opening and closing driving means so that the shutter blade opens and closes an optical path of an object image, the apparatus comprising: shutter blade opening direction biasing elastic means; shutter blade driving means for performing at least shutter blade closing direction drive; locking means for locking the shutter blade in a closed state; and lock driving means for driving the locking means and thereby

performing lock releasing of at least the shutter blade, wherein the lock driving means is composed of a shape memory alloy member.

[Claim 10] A shutter apparatus for a camera according to Claim 9, wherein the shape memory alloy member has a wire shape, and wherein a pin is provided for changing an extending direction of the wire-shaped shape memory alloy member.

[Claim 11] A shutter apparatus for a camera according to Claim 10, wherein the pin is provided with guiding means for preventing a plurality of the wire-shaped shape memory alloy members abutting against the pin from contacting with each other.

[Claim 12] A shutter apparatus for a camera according to Claim 10, wherein the pin is provided with guiding means for covering surroundings below the extending direction of the wire-shaped shape memory alloy member.

[Claim 13] A shutter apparatus for a camera according to Claim 9, wherein the shape memory alloy member is connected in series to a coil serving as the shutter blade driving means via a semiconductor device.

[Claim 14] A shutter apparatus for a camera according to Claim 9, wherein closed lock by the locking means is not performed for a desired time after a use of the lock driving means.

[Claim 15] A shutter apparatus for a camera according to Claim 14, wherein when the shutter blade is to be set into a closed

state within the desired time, the shutter blade driving means exerts a closing direction bias, while after passage of the desired time, the locking means performs closed lock.

[Claim 16] A shutter apparatus for a camera provided with a shutter blade driven by shutter blade opening and closing driving means so that the shutter blade opens and closes an optical path of an object image, the apparatus comprising closed holding means for holding the shutter blade in a closed state, in states other than a photographing state and a photographing ready state.

[Claim 17] A shutter apparatus for a camera according to Claim 16, wherein the closed holding means is linked with a power switch mechanically and thereby holds the shutter blade in a closed state when the power switch is OFF.

[Claim 18] A shutter apparatus for a camera according to Claim 16, wherein the camera comprises tube retracting means for accommodating a lens part into a camera body, and wherein the closed holding means is mechanically linked with the tube retracting means and thereby holds the shutter blade in a closed state when the lens part is accommodated into the camera body.

[Claim 19] A shutter apparatus for a camera according to Claim 17 or 18, wherein the closed holding means is locking means for locking the shutter blade in a closed state.

[Claim 20] A shutter apparatus for a camera according to Claim

17 or 18, wherein the closed holding means is biasing means for biasing the shutter blade to a closed state.

[Claim 21] A shutter apparatus for a camera according to Claim 16, comprising releasing means for releasing the closed hold of the shutter blade performed by the holding means.

[Claim 22] A shutter apparatus for a camera according to Claim 21, wherein the camera comprises mirror means for switching from one to another between an optical path for leading an object image to an ocular plane and an optical path for leading the object image to a film plane, and wherein the releasing means is mechanically linked with the mirror means and thereby releases the closed state hold of the shutter blade immediately after the optical path for leading the object image to the film image plane is formed by an action of the mirror.

[Claim 23] A shutter apparatus for a camera according to Claim 16, wherein the camera comprises: mirror means for switching from one to another between an optical path for leading an object image to an ocular plane and an optical path for leading the object image to a film plane; and mirror driving means for driving the mirror means, wherein the holding means is mechanically linked with the mirror driving means and thereby holds the closed state of the shutter blade immediately before the optical path for leading the object image to the film plane is formed by



an action of the mirror means, and wherein also after the object image is led to the film plane, the closed hold of the shutter blade is released by driving the mirror driving means.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Field of the Invention] The present invention relates to a shutter apparatus in a still camera and in particular to a shutter apparatus for a lens shutter camera having a mirror for switching from one to another between an optical path for leading an object image to a camera film plane and an optical path for leading the object image to an ocular plane.

[0002]

[Prior Art] In a single lens reflex camera, a shutter mechanism is provided on the film side relative to a mirror for switching from one to another between an optical path for leading an object image to a film plane and an optical path for leading the object image to an ocular plane. Thus, a space is necessary between the mirror and the film. Further, the shutter is formed immediately before the film, and hence the shutter opening needs to be formed larger than the film exposure plane. Then, the shutter driving section is arranged on its outside. This inevitably causes a size increase. Further, a diaphragm for adjusting the incident light quantity also needs to be provided

separately. This causes a cost increase as well as a weight increase. Furthermore, in the case of a high speed shutter, exposure is performed in a slit shape traveling across the film plane. This causes exposure unevenness when the flashed light from a strobe is used. When the unevenness is to be avoided, a shortcoming has arisen that a high speed shutter cannot be used when a strobe is used.

[0003] Thus, in recent years cameras have been available in which a lens shutter free from the above-mentioned shortcomings is arranged on the object side relative to the mirror.

[0004] In such a camera, the mirror has a sufficient light shielding function so that light does not leak to the film plane at the time of mirror down (a state that the mirror forms an optical path for leading the object image to the ocular plane: mirror down, hereinafter). At that time, the lens shutter is open so that the object is seen through an ocular section. At the time of photographing, the shutter is closed. Then, a mirror up state is formed (a state that the mirror forms an optical path for leading the object image to the film plane: mirror up, hereinafter) so that the light shielding to the film plane is stopped. (Light shielding is not performed because the shutter is closed.) Then, the shutter is opened and closed. After the completion of the exposure, the mirror goes down.

Finally, the shutter is opened so that the sequence is completed.

[0005] Not only in a photographing state or a photographing ready state (a state that a lens cap is removed or a certain operation is performed) but also at a time that the camera is not used (a state that the camera is placed freely or a state that a user is walking around with the camera), the shutter is open so that light leakage to the film is prevented by the mirror light shielding.

[0006] Such a camera provided with a mirror has a large advantage that the image itself to be photographed can be checked through a finder. Nevertheless, a space is necessary for the mirror and its swing. Thus, a camera has been developed in which the lens is accommodated into the space for the mirror so that the size is reduced when the camera is not used.

[0007] FIG. 19 shows a sectional view of such a camera. Numeral 51 indicates a lens shutter. Numeral 52 indicates a mirror. Numeral 53 indicates a film plane. Numeral 54 indicates an ocular plane. Numeral 55 indicates a lens tube. Numeral 56 indicates a camera body. Numeral 57 indicates a prism for leading the object image reflected by the mirror to the ocular plane.

[0008] In FIG. 19, when a power switch not shown is turned OFF when the camera is not used, the mirror 52 goes into a mirror

up state indicated by a broken line. Then, the lens tube 55 performs tube retraction and is accommodated into the space from which the mirror has retreated.

[0009] In this configuration, when the camera is not used, the mirror is up, and hence light shielding by the mirror is not expected. Thus, the shutter needs to be held in a closed state for light shielding. Thus, the entire sequence becomes as follows. The lens tube moves out when the power switch is turned ON. Then, the mirror goes down and performs light shielding to the film plane. Then, the shutter opens so that the optical path leads to the ocular plane. The sequence at the time of photographing is as described above. When the power switch is turned OFF on completion of camera use, the shutter first is closed. Then, the mirror goes up, and then the tube retraction of the lens tube is performed.

[0010]

[Problems to be Solved by the Invention] As described above, the shutter blade needs to be in a closed state when the camera is not used. This is achieved when the shutter blade is biased to the closing direction by a spring similarly in a prior art lens shutter.

[0011] FIG. 18 shows a prior art lens shutter. Shutter blades 41a and 41b are supported in a manner pivotable respectively

around pins 45a and 45b standing on a shutter base plate 42. A lever pin 44 of a shutter actuator 43 is fit into elongate holes 41c and 41d respectively provided in the shutter blades 41a and 41b. Rotation of the lever pin 44 in an arrow 47 direction causes opening operation of the shutter blades 41a and 41b. A spring 46 is hung on the shutter blade 41a and thereby exerts a closing direction bias to the shutter blades 41a and 41b. Thus, in a normal state (when the camera is not used), the shutter blade is maintained in a closed state by the spring 46. Thus, the shutter actuator 43 performs the opening operation of the shutter blades against the spring 46.

[0012] Meanwhile, when such a lens shutter is to be applied to a camera, the following inconvenience arises.

[0013] As described above, in a camera photographing ready state, the mirror 52 needs to be in the mirror down state so that the optical path for leading the object image to the ocular plane needs to be formed. At that time, the shutter blades of the shutter 51 need to be in the opened state. Thus, the shutter actuator 43 needs to always hold the opened state against the shutter blade closing direction biasing force of the spring 46. Thus, in the photographing ready state, the consumption current amount increases in the shutter actuator coil, and so does the heat generation in the coil itself. Generally, the

photographing ready state is longer than the duration of photographing. Further, the photographing ready state could always be maintained when the power switch was forgotten to be turned OFF. These situations can cause consumption in the battery. Further, heat generation in the shutter actuator coil can cause problems of deformation in the coil as well as various influences to other parts.

[0014]

[Means for Solving the Problem and its Action] Solving means of a first group of the invention has a configuration according to Claims 1 to 8. Provided are: a lens shutter mechanism; and a mirror mechanism having a light shielding property and switching from one to another between an optical path for leading an object image to a film plane and an optical path for leading the object image to an ocular plane. In an unused state, the mirror mechanism forms the optical path for leading the object image to the film plane, while a lens performs tube retraction and is thereby accommodated into a space where the mirror mechanism had located in order to form the optical path for leading the object image to the ocular plane. Locking means for locking a shutter blade in a closed state, an opened state, or both states is provided so that shutter blade opening and closing driving means performs lock and lock releasing of the

shutter blade by the locking means. Thus, the above-mentioned problems are avoided.

[0015] Solving means of a second group of the invention has solving means according to Claims 9 to 15. In a camera, a mirror is provided that has light shielding property and that switches from one to another between an optical path for leading an object image to an ocular plane and an optical path for leading the object image to a film plane. When the camera is not used, the mirror forms the optical path for leading the object image to the film plane, while a lens performs tube retraction and is thereby accommodated into a space where the mirror had located in order to form the optical path for leading the object image to the ocular plane, so that the size is reduced in the camera. Then, a lens shutter mechanism is provided on the object side relative to the mirror, while the lens shutter comprises: a shutter blade opening direction bias spring; a shutter blade drive unit for performing at least shutter blade closing direction drive; locking means for locking the shutter blade in a closed state; and lock driving means composed of a shape memory alloy member for driving and causing the locking means to perform at least lock releasing. Thus, the above-mentioned problems are avoided.

[0016] Solving means of a third group of the invention, which

is according to the invention, closed holding means is provided for holding a shutter blade in a closed state, in states other than a photographing state and a photographing ready state. Thus, the above-mentioned problems are avoided. Specifically, a mirror is provided that has light shielding property and that switches from one to another between an optical path for leading an object image to an ocular plane and an optical path for leading the object image to a film plane. When the camera is not used, the mirror forms the optical path for leading the object image to the film plane, while a lens is accommodated into a space where the mirror had located in order to form the optical path for leading the object image to the ocular plane, so that the size is reduced in the camera. Then, a lens shutter mechanism is provided on the object side relative to the mirror, while the lens shutter open and closing direction bias spring is not provided, or alternatively a shutter blade opening direction bias spring is provided. Closed holding means is provided for holding the shutter blade of the lens shutter in a closed state when the camera is not used. Thus, the above-mentioned problems are avoided.

[0017]

[Embodiments] FIG. 1 shows a first embodiment of the invention. The major difference from the prior art example of FIG. 18 is



as follows. First, the spring 46 biases the shutter blades 41a and 41b to the opening direction. This avoids the necessity of driving the shutter actuator (shutter opening and closing driving means) in order to open the shutter in the photographing ready state. Second, a closed locking lever 11 of a push-push type is formed in a manner pivotable around a pin 14. The locking lever 11 receives a biasing force in an arrow 15 direction from a spring 12. A rear end 11a of the locking lever contacts with a stopper pin 48 standing on the shutter base plate 42, so that its rotation is stopped. (In FIG. 1, the locking lever rear end 11a does not yet contact with the stopper pin 48. Instead, a closed lock pin 13 described later enters to the front end 11b of the locking lever so that the rotation is stopped.) The closed locking lever 11 is pressed against the shutter base plate 42 by the spring 12. However, a weak force can lift the closed locking lever front portion 11b to the object side in the optical axis direction. In the above-mentioned configuration, the operation of the closed locking means is described below by following the sequence of photographing starting at the photographing ready state.

[0018] In the photographing ready state, the shutter is opened by the spring 46 so that the optical path for leading the object image to the ocular plane is formed. Then, when a release button

is pushed for photographing, a shutter actuator 43 (shutter opening and closing driving means) biases the shutter blades to the closing direction through a driving lever 44 so that the shutter blades begin to move to the closing direction against the spring 46. A closed lock pin 13 is formed in the shutter blade 41a. When the closed lock pin 13 moves to the closing direction and then contacts with the slant face 11c of the closed locking lever, the closed lock pin 13 turns the closed locking lever 11 in the direction opposite an arrow 15 by means of a closing direction biasing force of the shutter actuator 43. Then, when the closed lock pin 13 passes the slant face 11c of the closed locking lever 11, the closed locking lever having been pushed by the closed lock pin and thereby turned in the direction opposite the arrow 15 until that time begins to rotate in the direction of the arrow 15. Thus, the closed lock pin contacts with a pawl 11d of the closed locking lever.

[0019] When power to the shutter actuator 43 is stopped at this time, the shutter blades begin to open in the opening direction. However, in accordance with this open operation and the rotating operation in the arrow 15 direction of the closed locking lever 11, the closed lock pin 13 enters into a recess 11e in the front portion of the closed locking lever, and thereby performs closed state lock of the shutter blades (FIG. 1). The closed lock

pin 13 is in contact with a camber section 11f of the closed locking lever. Thus, the closed locking lever 11 is not rotated by the spring 12. After that, the mirror goes up and thereby forms the optical path for leading the object image to the film plane. However, the shutter is in the closed state, and hence exposure is not performed. Then, when the shutter actuator 43 biases the shutter blades to the closing direction again, the closed lock pin departs from the side of 11f of the camber section, and then enters into a recess 11g. When power to the shutter actuator 43 is stopped, the shutter blades are to move in the opening direction by means of the spring 46. An end of the camber section 11f is curved to the object side in the optical axis direction. Thus, when moving in the opening direction, the closed lock pin 13 enters under the camber section 11f, and then lifts the closed locking lever front portion 11b from the shutter base plate 42. After that, the closed lock pin 13 departs from the closed locking lever 11 so that the shutter is opened into the exposure state. The shutter open operation after the lock releasing may be performed by the opening direction biasing force of the shutter actuator 43. After that, the shutter actuator 43 biases the shutter blades to the closing direction, and thereby closes the shutter so as to complete the exposure. At the same time, closed state

lock is performed again. Then, the mirror goes down so that light shielding to the film plane is performed. Closed lock releasing is performed again in a series of the above-mentioned operations. Thus, the shutter opens so that the optical path for leading the object image to the ocular plane is formed.

[0020] When the camera is to be brought into an unused state, the power switch not shown is turned OFF. Then, the shutter actuator 43 first brings the shutter into the closed state and performs closed lock. Then, the mirror goes up. Then, the lens performs tube retraction and is thereby accommodated into the space of mirror down. Then, the power supply is turned OFF.

[0021] When the camera is to be brought into the photographing ready state, the power switch not shown is turned ON. The lens moves out. Then, the mirror goes down so that light shielding to the film plane is performed. Finally, the shutter actuator 43 performs closed lock releasing so that the optical path between the object image and the ocular plane is formed.

[0022] According to the above-mentioned configuration, the shutter actuator 43 does not need to be provided with a current for always maintaining the shutter open in the photographing ready state. This avoids the problems of exhaustion of the battery and generation of heat. Further, since the closed holding means is provided, even when the mirror is up and hence

light shielding is not performed by the mirror, sufficient light shielding to the film plane is achieved by the shutter without continuously providing a current to the shutter actuator.

[0023] The actuator itself for driving the opening and the closing of the shutter performs closed lock and lock releasing. Thus, a feature is obtained that even when the battery is extracted in any state, the camera does not suffer light beam leakage to the film.

[0024] FIG. 2(a) shows another embodiment. An elastic lever 16 having a spherical protrusion 16a is provided in place of the closed locking lever 11 of the push-push type shown in FIG. 1. The elastic lever 16 is composed of the same member as the shutter base plate 42, and fabricated by forming a slit having a shape identical to the elastic lever 16. The spherical protrusion 16a bends elastically in the optical axis direction around a pedestal portion (boundary portion of the shutter base plate 42 and the elastic lever 16). A hole 17 is formed also in the shutter blade 41a.

[0025] When the power switch is turned ON so that the camera goes into the photographing ready state, the lens first moves out. Then, the mirror goes down. After that, when the shutter actuator not shown exerts a biasing force in the opening direction onto the shutter blades in the state of FIG. 2(a),

the spherical protrusion 16a having fit into the hole 17 elastically retreats to the film side in the optical axis direction. (The spherical protrusion 16a is pushed by the hole 17 periphery so that the elastic lever 16 bends owing to a force component in the optical axis direction.) Then, when the blade 41a having the hole 17 moves over the spherical protrusion 16a, the shutter blades are opened into the photographing ready state (FIG. 2(b)) by the force of the spring 46.

[0026] When a release button is pushed for photographing, the shutter blades are closed by the closing direction biasing force of the shutter actuator. Even after the blade 41a contacts with the spherical protrusion 16a, the shutter actuator continues to exert the closing direction biasing force to the shutter blade. Then, the spherical protrusion 16a elastically retreats to the film side in the optical axis direction owing to the force in the closing direction of the shutter blade 41a similarly to the above-mentioned case. The shutter blade 41a moves over the spherical protrusion 16a so that the hole 17 overlaps with and fits over the spherical protrusion 16a. The shutter blade is stopped by the stopper pin 18 so as not to move further to the closing direction. In this state, the shutter blade is locked in the closed state by the spherical protrusion 16a and the hole 17. Then, the mirror goes up so

that the optical path to the film plane is formed. Then, when the shutter actuator biases the shutter blade to the opening direction, the shutter blade 41a moves over the spherical protrusion 16a so that open operation is performed. After the exposure, the shutter actuator biases the shutter blade to the closing direction so that the shutter is closed. Then, the spherical protrusion 16a fits into the hole 17 so that closed state lock is performed. Then, the mirror goes down so that the state returns to the photographing ready state.

[0027] When the camera is to be brought into an unused state, the power switch is turned OFF. Then, the shutter actuator biases the shutter blade to the closing direction so that the shutter blade 41a moves over the spherical protrusion 16a. Then, the hole 17 fits over the spherical protrusion 16a so that closed lock is performed. After that, the mirror goes up. Then, the lens performs tube retraction and is thereby accommodated. Then, the procedure is completed.

[0028] This configuration is simpler than that employing the closed locking lever of the push-push type of FIG. 1. Even when the shutter is to be brought into the opened state, the shutter actuator does not need to bias the shutter blade to the closing direction once. This simplifies the control, and reduces a time lag for opening the shutter.

[0029] The shutter blades are notably thin in practice. Hence, the shutter blades themselves easily bend elastically in the optical axis direction. Thus, the elastic lever 16 may be omitted so that the spherical protrusion 16a may be attached directly to the shutter base plate 42. Then, the shutter blade may move over the spherical protrusion 16a by means of elastic bending.

[0030] FIG. 3(a) shows a modification of FIG. 2. A lock pin 60 is formed at a tip of a shaft 19 via an elastic member 61. When the shutter blade is in the closed state, as shown in FIG. 3(a), the stopper 62 formed in the shutter blade 41a is located in the inner side of the lock pin 60 and thereby performs opened lock. In this state, when the shutter actuator biases the shutter blade to the opening direction, the stopper 62 pushes the lock pin 60 in the arrow 63 direction. Then, the elastic member 61 bends so that the stopper 62 departs from the lock pin 60. Thus, the shutter blade goes into the opened state (FIG. 3(b)). According to this configuration, no optical axis direction bending force acts on the shutter blade so that reliability increases in the blade.

[0031] FIG. 4 shows another modification. A magnetic material 64 is attached to an edge of the shutter blade 41a, and is attracted to a permanent magnet 65 attached to the shutter base plate



42 in the shutter closed state so as to perform shutter closed lock. When the shutter actuator biases the shutter blade to the opening direction in order to make the shutter into the opened state, the attraction between the magnetic material 64 and the permanent magnet 65 is separated by the force so that the shutter blades are opened. The magnetic attraction force is in inverse proportion to the square of mutual distance so that the attraction force becomes weaker rapidly when the shutter is opened. Thus, opened hold is achieved by the spring 46. According to this configuration, closed lock is performed by a mechanism employing no elastic material. Thus, the closed state is maintained in a manner resistive to external disturbance and the like.

[0032] In FIG. 4, the magnetic material 64 may be fabricated by magnetic plating. The permanent magnet 65 may be shared with the permanent magnet of the shutter actuator. An electromagnet (having such a configuration that releasing is achieved when the power is ON while attraction is achieved when the power is OFF) may be used in place of the permanent magnet 65.

[0033] In the embodiment of FIGS. 1 through 4 described above, the shutter blade is biased to the opening direction by the spring 46. However, this spring 46 may be omitted so that opened

hold may be performed by means of a notably small current at the time of open (In the prior art, a large opened hold current has been necessary in order to perform opened hold against the closing bias spring. However, in the present embodiment, there is no need for opposing a spring so that a small opened hold current is sufficient). In this case, there is no need for opposing the opened hold spring 46 when the shutter blades are closed. This alleviates battery exhaustion, and permits size reduction in the shutter actuator. This contributes to the overall size reduction.

[0034] FIG. 5 shows a second embodiment of the invention. The major difference from the first embodiment is as follows.

[0035] First, the spring 46 biases the shutter blade to the closing direction. Second, the elastic lever 16 having the spherical protrusion 16a fits into the hole 17 of the shutter blade 41b in the shutter blade opened state. Third, inhibiting means 23 for inhibiting the lock is provided.

[0036] The configuration of FIG. 5 is described below as well as its operation along with a camera sequence. First, in a state that the camera is not used, the shutter blade is biased and held in the closed state by the spring 46. Then, when the power switch not shown is turned ON into the camera photographing ready state, the lens not shown moves out first. Then, the

mirror not shown goes down. After that, the shutter blade is brought into the opened state against the spring 46 by the shutter actuator (not shown). Then, as described above, the shutter blade 41b moves over the spherical protrusion 16a. Then, the hole 17 and the spherical protrusion 16a fit together so that the shutter blades are held in the opened state. At this time, the opened lock position is configured such that the opening of the shutter blades is sufficiently larger than the opening diameter of the aperture 24.

[0037] When the shutter blades are in the opened state, the optical path between the object image and the ocular plane is formed so that the photographer can check the object. In this shutter blade opened lock state, power to the shutter actuator is stopped so that the consumption of the battery is prevented.

[0038] Then, when the release switch is turned ON for photographing, the shutter actuator biases the shutter blade to the closing direction so that the shutter blade 41b moves over the spherical protrusion 16a, and performs opened lock releasing. After that, the shutter blade is closed owing to the action of the spring 46. Then, the mirror goes up so that the light shielding to the film plane is stopped. Then, the inhibiting means 23 operates. First, a plunger 22 goes ON so that an inhibition bar 21 moves out to the object side in the

optical axis direction. Then, a tip 21a of the inhibition bar 21 protrudes from the shutter base plate 42 (FIG. 5). Then, the shutter actuator biases the shutter blade into the opened state so that exposure is performed. At this time, the inhibition bar tip collides with the shutter blade 41b, and hence the shutter blade 41b cannot move over the spherical protrusion 16a. Thus, opened lock is not performed. The shutter diameter direction position of the inhibition bar tip is configured such that when the inhibition bar tip 21a collides with the shutter blade 41b, the opening of the shutter blades agrees with the aperture opening diameter. The shutter actuator continues to bias the shutter blade to the opening direction until the exposure is completed. After the completion of exposure, the shutter actuator biases the shutter blade to the closing direction so that the shutter is closed (the shutter blade may be closed by the spring 46). Then, power to the plunger 22 is turned OFF so that the tip 21a of the inhibition bar is retreated from the shutter base plate 42 by the force of the spring 25. Then, the mirror goes down so that the state returns to the photographing ready state.

[0039] The reason why the inhibiting means 23 is provided in the present embodiment is that if shutter blade closed lock and release were performed for every exposure, high speed shutter

could not be achieved. Thus, the inhibiting means may be used only when high speed shutter is required. In that case, in low speed shutter, the shutter actuator does not need to continue to bias the shutter blade to the opening direction. This permits power savings.

[0040] When the camera goes from the photographing ready state into an unused state, the power switch is turned OFF so that the shutter actuator biases the shutter blade to the closing direction. Then, the shutter blade 41b moves over the spherical protrusion 16a so that opened lock releasing is performed. After that, the shutter blade goes into the closed state by the force of the spring 46. Then, the mirror goes up so that the lens performs tube retraction and is accommodated. As such, the camera reaches the unused state.

[0041] According to this configuration, when the camera is not used, the shutter blade is biased in the closed state. This avoids that the shutter blades continue the opened state owing to external disturbance and the like, and hence improves the reliability in light shielding.

[0042] FIG. 6 shows another modification. The plunger 22 serving as the driving source of the inhibiting means is omitted. Instead, the driving source of the mirror 26 is used in the inhibiting means.

[0043] In FIG. 6, when the mirror is in the up state such as when the camera is not used and when photographing is performed, a pin 28 standing on the mirror drive gear 27 rotated by the mirror motor 29 pushes an end 21b of the inhibition bar 21 (FIG. 6 shows the unused camera state). Thus, the inhibition bar tip 21a protrudes from the shutter base plate 42 and thereby inhibits the opened lock of the shutter. This avoids that the opened lock is performed at the time of exposure and hence prevents high speed shutter.

[0044] In the camera photographing ready state, the mirror is in the mirror down state. Thus, the pin 28 is located in a position 28' indicated by a broken line. Thus, the tip 21a of the inhibition bar 21 is retreated from the shutter base plate 42 owing to the spring 25. As a result, the opened lock of the shutter blade can be performed in the photographing ready state.

[0045] The above-mentioned configuration avoids the necessity of separately providing electromagnetic means for the inhibiting means. This permits size and weight reduction.

[0046] FIG. 7 shows a third embodiment of the invention. The difference from the above-mentioned examples is that opened locking means and closed locking means are provided and that the spring for biasing the shutter blade to the closing direction

or the opening direction is omitted.

[0047] When FIG. 7 is compared with FIG. 5, the shutter closing direction bias spring is omitted. Instead, the spherical protrusion 16a for closed lock is formed.

[0048] The operation is the same as the above-mentioned examples in that the biasing force of the shutter actuator performs closed lock releasing, opened lock, opened lock releasing, and closed lock, and that the opened lock inhibiting means operates at the time of photographing. However, when locking means is provided for both of opening and closing as shown in FIG. 7, the bias spring of the opening direction and the closing direction becomes unnecessary. The opening and the closing of the shutter blade is driven by the shutter actuator. At this time, no spring is used in contrast to the above-mentioned examples. This avoids that a temperature change or the like causes a change in the spring constant and hence causes unevenness in the rise rate at the time of shutter opening and closing. This permits precision exposure. Further, avoided is the necessity of continuing to drive the shutter against the spring. This permits power savings.

[0049] FIG. 8 shows an example where similar conditions are realized on the basis of the structure of FIG. 6. The operation and the like are similar to those described above and those

of FIG. 6. Thus, overlapping description is omitted. However, no shutter opening and closing bias spring is provided. Further, no plunger of the inhibiting means is provided. This permits further power savings.

[0050] FIG. 9(a) shows an example where a spring 31 is used as the opening and closing locking means of FIG. 8. In the vicinity of the shutter blade closed state, a lever 31 pushes a pin 34 provided in the shutter blade 41a, in the inner side of a pivot 45a of the shutter blade 41a (FIG. 9(a)). Thus, the spring 31 generates a biasing force in the closing direction. In the vicinity of the shutter blade opened state, the lever 31a pushes the pin 34 at the outer side of the pivot 45a (FIG. 9(c)). Thus, a biasing force is generated in the opening direction. Thus, the spring 31 serves as the opening and closing locking means. Further, in the shutter blade moving state, the lever 31a biases the pin 34 on the line connecting the pivot 45a as shown in FIG. 9(b). Thus, the spring force of opening and closing decreases remarkably.

[0051] This permits power saving and simplifies the structure similarly to the example of FIG. 8.

[0052] According to the above-mentioned embodiments, the shutter opening and closing locking means is provided. This permits notable power savings in comparison with a prior art



shutter in which opened hold is performed by an actuator. Further, light shielding to the film plane is ensured when the camera is not used. Furthermore, the shutter actuator performs lock and lock releasing of opening and closing. This permits size and weight reduction in comparison with the case in which another dedicated driving means performs lock and lock releasing.

[0053] FIG. 10 shows an embodiment of the invention. Components having functions like those of the prior art lens shutter of FIG. 18 are designated by like numerals.

[0054] The major difference of FIG. 10 from the prior art example of FIG. 18 is that a spring 146 biases the shutter blades 41a and 41b to the opening direction. Further, a lock pin 113 is formed in the shutter blade 41a. As an enlarged view is shown in FIG. 11(a), locking means 116 is in a stationary state where the tension is balanced in the arrow 129 direction of the wire-shaped shape memory alloy member 111 arranged over a locking lever 112, a spring 114 for biasing the locking lever 112 in the arrow 128 direction, and a drive pin 112b provided in the locking lever 112. Both ends of the wire-shaped shape memory alloy member 111 are fixed to the camera body by screws 123 and 124. The end fixed by the screw 124 is grounded. Deflection pins 121 and 122 serve to change the extending direction of

the wire-shaped shape memory alloy member. This permits the use of a longer wire-shaped shape memory alloy member in a smaller space, and hence increases the stroke of expansion before and after the restoration by heating.

[0055] In the above-mentioned configuration, described below is the operation for transiting to the unused camera state after the completion of photographing.

[0056] First, when the power switch is turned OFF, the shutter blade is driven to the closing direction against the spring 146 by the shutter blade driving means. Then, immediately before the close, the lock pin 113 collides with the tip 112a of the lock pin 112 in the trajectory of the arrow 150. Then, since a taper portion 112c is provided in the lock pin tip 112a, the locking lever 112 is lifted up in the direction of the arrow 151 against the spring 114 by the force of the lock pin 113. When the lock pin 113 passes the locking lever tip 112a, the locking lever 112 is returned to the original position by the spring 114. Then, when the closing direction drive by the shutter blade driving means is stopped, the shutter blades 41a and 41b are biased to the opening direction by the spring 146. However, the shutter blades 41a and 41b are locked by a locking claw 112d of the locking lever 112, and thereby goes into a closed lock state. After that, the mirror goes up. Then, the

lens performs tube retraction and is thereby accommodated into the space where the mirror has been located at the time of mirror down. As such, the state reaches the unused camera state. [0057] When the camera is to be brought into the photographing ready state, the power switch is turned ON first. Then, the lens moves out so that the mirror goes down. Then, a voltage is applied to an end (the side fixed by the screw 123) of the shape memory alloy member 111 so that a current is provided in the shape memory alloy member 111. Then, heat is generated. The shape memory alloy member 111 is deformed in the expanding direction by the spring 114. However, when heat is provided, the shape memory alloy member restores and shrinks. Then, the locking lever 112 moves in the arrow 121 direction against the spring 114. The lock pin 113 departs from the locking claw 112d. The shutter blades 41a and 41b go into the opened state owing to the spring 146. As such, the state reaches the photographing ready state. When power to the shape memory alloy member 111 is stopped, the shape memory alloy member 111 cools so that the locking lever 112 returns to the original position owing to the force of the spring 114.

[0058] At the time of photographing, when the release button is pushed, the shutter blades are first closed and locked by the shutter blade driving means. Then, the mirror goes up,

while power is provided to the shape memory alloy member so that lock releasing is performed. Then, the shutter blades are opened and closed so that exposure to the film is performed. Then, in a state that the shutter blades are biased by the shutter blade driving means, the mirror goes down. Then, the power to the shutter blade driving means is stopped so that the shutter blades are opened by the spring 146.

[0059] The reason why the shutter blades are biased to the closing direction by the shutter blade driving means after the exposure in the present embodiment is that the shape memory alloy member 111 is not cooled down sufficiently at that stage, and hence the shutter blades cannot go into the closed lock state by means of the locking lever 112.

[0060] A similar situation occurs also in the unused camera state. When the camera is in an unused state immediately after the lock releasing performed by the shape memory alloy member (such as immediately after the exposure or immediately after the photographing ready state is established), the shape memory alloy member is not sufficiently cooled down. Thus, the configuration is designed such that even when the power of the camera is turned OFF, the camera does not go into the unused state for a while (1-2 seconds), or alternatively the shutter blade driving means continues to bias the shutter blades to

the closing direction for a while after the camera goes into the unused state.

[0061] Further, the pins 121 and 122 for changing the extending direction of the shape memory alloy member 111 wire in order to increase the line length are provided with grooves 125a and 125b as guiding means as shown in FIG. 11(b). The shape memory alloy wire member 111 goes through these grooves 125a and 125b. This avoids that the wires go into a contacting and conductive state with each other so that a short circuit current flows. The guiding means may be formed in the form of guide holes 126a and 126b as shown in FIG. 11(c).

[0062] The shape memory alloy member 111 is hard to be bent and restores owing to heat. In order to prevent these, a cover 127 serving as guiding means for covering the surroundings of each of the pins 121 and 122 may be provided as shown in FIG. 11(d). This prevents the bending portion of the shape memory alloy member 111 from loosening and spreading.

[0063] In the above-mentioned embodiment, the shutter blade driving means and the lock driving means (shape memory alloy member) are driven separately. Thus, power to each needs to be controlled separately. This has caused complexity in the control sequence. However, as shown in FIG. 12, the coil 143a of the shutter blade driving means and the shape memory alloy

member may be connected in series via a diode (semiconductor device) 131a. Further, when the connection end of the coil 143a side is grounded via a diode 131b, the shutter blade driving means and the lock driving means are driven in a series of operations. This simplifies the sequence notably.

[0064] In FIG. 12, when the shutter blades are to be closed, a current "is" flows as indicated by an arrow 132, while no current flows into the shape memory alloy member by virtue of the semiconductor 131a. Thus, similarly to the above-mentioned case, the lock pin 113 engages with the locking claw 112d, and is closed-locked. Then, when the shutter blades are to be opened, a current "io" flows as indicated by an arrow 133 so that the shape memory alloy member is heated. Thus, lock releasing is performed so that the shutter blades are opened by the force of the shutter blade driving means and the spring 146.

[0065] In this case, shutter open and close are compared, the total of the resistance of the energized portions is larger at the time of shutter open. Thus, the shutter blade opening direction driving force is smaller than the shutter blade closing direction driving force. However, the spring 146 biases the shutter blades to the opening direction so that the difference between the driving forces of opening and closing is compensated by the spring force of the spring 146.

[0066] In the above-mentioned example, the shape memory alloy member has been of a one-way memory type, and hence a tension has been provided by a spring force (the spring 114). However, the invention is not limited to this. The spring 114 may be omitted, while a shape memory alloy member of a two-way memory type may be used so that lock may be performed when cooling while lock releasing may be performed when the power is ON.

[0067] When the locking means is driven by the shape memory alloy member as described in this example, a notably compact and light weight shutter blade holding apparatus is obtained in comparison with the case that the drive is performed by another means (a plunger or the like).

[0068] As described above, when the locking means is driven by the shape memory alloy member as described in this example, a notably compact and light weight shutter holding apparatus is obtained in comparison with the case that the drive is performed by another means (a plunger or the like).

[0069] Further, when the pins for changing the extending direction of the shape memory alloy member are provided, the line length of the shape memory alloy member can be increased in a smaller space. This increases the restoration stroke due to heating, and improves the reliability of lock releasing.

[0070] Further, in the case that the shape memory alloy member

is connected in series to the shutter blade driving means coil via the semiconductor, when power is supplied to the shutter blade driving means coil in order to move the shutter blades in the opening direction, closed lock is released automatically. Thus, a special closed lock releasing command is not necessary. This simplifies the configuration.

[0071] FIG. 13 shows a fifth embodiment of the invention. Components having functions like those of FIG. 18 are designated by like numerals, and hence description is omitted. In FIG. 13, an opening direction bias spring 246 is formed in the shutter blade 41b. In the photographing ready state, the shutter blade is the opened state. Thus, no opening direction biasing current is necessary in the shutter actuator coil in the photographing ready state. Then, at the time of photographing, the shutter actuator (not shown in FIG. 13) brings the shutter blades 41a and 41b into the closed state against the spring 246. Then, the mirror 211 having prevented light from entering into the film plane 212 in the photographing ready state goes up into the mirror up state. After that, reversed power is supplied to the shutter actuator so that the shutter blades are opened. After the film exposure, power is supplied again to the actuator so that the shutter blades are closed. Then, the exposure is completed. Then, the mirror goes down so that light shielding



to the film plane 212 is performed. At the same time, the optical path between the object image and the ocular plane is formed. After that, power to the actuator is stopped so that the shutter blades 41a and 41b are brought into the opened state by the force of the spring 246. At that time, the object is seen through the ocular plane.

[0072] After the completion of photographing, when the camera is to be brought into the unused state, the power switch 213 is first slid in the arrow 214 direction. Then, a switch 215 using impedance change or the like and provided in the power switch upper face detects that a finger has touched the switch. Then, the shutter actuator brings the shutter blades 41a and 41b into the closed state. When the power switch is slid further, a bias plate 216 integrated with the power switch 213 pushes an end 217a of the holding lever 217 so that a tip 217b of the holding lever 217 protrudes from the front face of the base plate 42 of the lens shutter and thereby prevents the shutter blades from going in the opened state (the shutter blades are locked in the closed state). Then, when the finger disengages from the power switch, power to the shutter actuator stops. However, the shutter is maintained at the closed state by the holding lever 217. Then, the mirror 211 goes up owing to the revolving force of the mirror drive motor 218. Then, the lens

is accommodated in the position of mirror down. After that, all power supplies are turned OFF. Here, an elastic section 217c is formed in the end 217a of the holding lever 217. Thus, when the power switch 213 is too rapidly slid in the arrow 214 direction, the holding lever 217 does not respond.

[0073] Then, when the power switch 213 is slid in the direction opposite the arrow 214 in order to realize the photographing ready state, all power supplies are turned ON. The lens moves out. The mirror drive pin 260 departs from the mirror 211 owing to the reverse rotation of the mirror drive motor 218. Then, the mirror 211 goes into the mirror down state owing to the force of the spring 219 (FIG. 13 shows this state). However, a stopper 261 enters into a notch 217d' of the holding lever 217 so that the shutter closed hold state is maintained. The stopper 261 is supported in a manner pivotable around a stopper support pivot 262 and biased in the rotational direction indicated by an arrow 264 by the spring 263. Thus, the stopper does not depart from the notch 217d. Then, even after the completion of mirror down, the mirror drive pin continues to revolve further and then pushes an end 265a of the release lever 265. Since the release lever 265 is supported in a manner pivotable around a release lever support pivot 266, when one end 265a is pushed, the other end 265b goes up relatively and

thereby pushes an end 261a of the stopper 261 so that the stopper 261 departs from the notch 217d. The release lever 265 is biased in the arrow 268 direction by the spring 267. Thus, unless the mirror drive pin 260 pushes the release lever end 265a, the end 261a of the stopper 261 is not pushed up. When the stopper 261 departs from the notch 217d, the holding lever retreats from the base plate 42 owing to the action of a spring 270 provided in the holding lever 217 and biasing the holding lever 217 to the arrow 269 direction. Then, closing direction hold of the shutter blade is terminated so that the shutter blades go into the opened state owing to the action of the spring 46.

[0074] According to the above-mentioned configuration, in the photographing ready state, the shutter actuator does not need to always be powered in order to maintain the shutter blades in the opened state. Thus, the above-mentioned problems are resolved. Further, the shutter is in the closed hold state when the camera is not used. Thus, light beams do not leak.

[0075] In the present example, when the camera goes from the unused state into the photographing ready state, the holding lever 17 does not retreat in linkage with the power switch. The reason for this configuration is described below.

[0076] When the camera goes from the unused camera state into

the photographing state, the following configuration is also possible in order to achieve the object. That is, the power switch is turned ON first. Then, the shutter actuator begins to bias the shutter blades to the closed state. Then, the lens moves out. Then, after the mirror down, power to the shutter actuator is stopped so that the shutter is opened. In this configuration, both of the protrusion and retreat of the holding lever may be linked with the power switch. This simplifies the structure notably. Nevertheless, after the power switch is turned ON, when the battery is removed before the mirror goes down completely, light shielding to the film plane by the mirror is not expected. Further, the shutter is in the opened state by the spring 246 so that the film is exposed. Thus, such a configuration is adopted that the holding lever retreats after the mirror goes down completely. In FIG. 13, in a case that the tip 217b of the holding lever 217 is attached to the holding lever 217 via an elastic section 271, when closed hold of the shutter blades is performed, the tip holds the blades in a state bent in the arrow 272 direction. That is, elastic hold is performed in the hold state (the shutter blades are biased in the closed state). This avoids looseness in the hold. [0077] In the description given above, the shutter actuator has closed the shutter when the power switch 213 has been touched.

However, the invention is not limited to this. Any switch means may be used that is linked with the operation of the power switch.

[0078] In the present invention, the opening direction bias spring has been provided in the shutter mechanism. This spring may be omitted so that the shutter blades may be opened-held by a small current in the photographing ready state (when no spring is used, the shutter blades can be driven by a notably small force). In this case, in the action of shutter closing (such as when the camera goes into the unused state and when the shutter is closed immediately before the mirror up for exposure), the shutter actuator does not need to oppose the springs in order to bring the blades into the closed state. This permits power saving and provides the advantage of size reduction in the shutter actuator itself.

[0079] FIG. 14 shows another modification of the invention. In FIG. 14, the holding lever 217 has an elongate hole 217d. A transmission bar 273 fits into the elongate hole 217d. Then, the holding lever 217 can slide on the transmission bar 273. The holding lever 217 is pressed by a pawl 274 protruding from the shutter base plate 42, and thereby does not depart from the shutter base plate. A cam 275 is formed in the transmission bar 273. When the power switch 213 is turned OFF, an end 277 (connected to the power switch 213 via an elastic body 276)

provided in the power switch 213 pushes an end 275a of the cam 275. Then, the transmission bar 273 rotates and thereby turns the holding lever 217 so that the shutter is brought into the locked state. Then, even when the power switch 213 is turned ON again, a recess 275b of the cam 275 is locked by the stopper 261 so that the transmission bar 273 does not rotate similarly to FIG. 13. Then, the mirror goes into the down state owing to the action of the motor 218. The motor 218 revolves further so that the mirror drive pin 260 pulls up the end 265a of the release lever 265. Then, another end 265b rotates the stopper 261 in the arrow 264 direction against the spring 263 so that lock by the stopper 261 of the recess 275b of the cam is released. The cam 275 is biased in the rotational direction indicated by an arrow 269 by the spring 270. Thus, when the stopper 261 departs, the transmission bar 273 rotates in the arrow 269 direction so that shutter blade closed state hold by the holding lever 217 is released.

[0080] The major difference of the above-mentioned configuration of FIG. 14 from that of FIG. 13 is that the holding lever 217 can slide on the transmission bar 273.

[0081] According to this configuration, even when the shutter mechanism moves in the optical axis direction (a situation that the shutter mechanism moves in the optical axis direction can

occur in the cases of AF, zoom, and lens accommodation in the unused camera state as described above), closed hold and release of the shutter blades are performed reliably.

[0082] FIG. 15 shows a sixth embodiment of the invention. A cam shape provided in a lens tube for holding the lens permits hold and release of the shutter blades.

[0083] In FIG. 15, a lens tube 222 rotates by means of a motor 221. This action permits the lens tube retraction and accommodation when the camera is not used as well as the lens move-out when the state goes into the photographing ready state. A transmission cam 223 for transmitting a force to the holding lever 217 is provided in the lens tube, while a follower 217a at an end of the holding lever 217 fits into the cam. When the camera is not used, the shutter blades 41a and 41b are first closed by the shutter actuator. Then, when the lens tube 222 rotates in the arrow 224 direction for the purpose of tube retraction and accommodation of the lens, the holding lever end 217a on the transmission cam 223 passes a slant section 223b of the transmission cam 223, and then reaches a parallel section 223c. Thus, the holding lever 217 is pushed forward in the optical axis direction so that the holding lever tip 217b protrudes from the shutter base plate 42 and thereby performs closed hold of the shutter blades 41a and 41b.

[0084] When the state goes into the photographing ready state, the actuator first performs bias hold of the shutter blades 41a and 41b in the closed state. Then, the lens tube 222 rotates in the direction opposite the arrow 224 for the purpose of lens move-out. The holding lever end 217a travels on the transmission cam 223 along a route connecting 223c, 223b, and 223a. The holding lever 217 is pulled backward in the optical axis direction. The holding lever tip 217b retreats from the shutter base plate so that the closed hold state is released. Then, power to the shutter actuator is stopped so that the shutter goes into the opened state owing to the spring 246.

[0085] The above-mentioned configuration simplifies the structure notably, and hence advantageously advances weight and size reduction.

[0086] FIG. 16 shows a seventh embodiment of the invention, where shutter blade closed hold is performed in linkage with the mirror driving means.

[0087] FIG. 16 shows the unused camera state. When the state goes into the camera photographing ready state by means of the power switch not shown, the shutter actuator performs holding bias of the shutter blades in the closing direction. The lens moves out. Then, a mirror drive gear 232 rotates in the arrow 233 direction by means of the motor 218. The mirror drive pin



260 pushes the mirror 211 biased in the mirror up state by the spring 219, and thereby brings the mirror into the mirror down state. At the same time, the release pin 260a pushes the holding lever 217 against the spring 270. Then, the holding lever tip 217b retreats from the shutter base plate 42 so that shutter blade closed hold release is performed. Then, the shutter blade closing direction bias by the shutter actuator is released. As a result, the shutter blade opened state is achieved by the spring 246 so that the object image can be checked through the ocular plane.

[0088] When the release button is pushed in photographing, the shutter actuator performs bias hold of the shutter blade in the closed state (FIG. 17(a)). Then, the motor 218 revolves so that the mirror drive gear 232 rotates in the direction opposite the arrow 233. Then, when the mirror drive pin 260 retreats, the mirror goes up owing to the action of the spring 219. The mirror abuts against stoppers 231a and 231b (FIG. 17(b)), and thereby stops. In this state, the shutter blades are closed-held by the holding lever 217, and hence opening and closing of the shutter cannot be performed. That is, exposure is impossible. The mirror drive gear 232 rotates further so that the release pin 260a pushes the end 217a of the holding lever 217 against the spring 270. Then, the holding

lever tip 217b retreats from the shutter base plate 42 so that closed hold release is performed (FIG. 17(c)). Then, the shutter actuator performs shutter blade opening and closing so that exposure to the film is performed. After that, the shutter actuator performs shutter blade closing direction bias hold. The mirror drive gear 232 rotates in the arrow 233 direction so that mirror down is performed. Then, shutter blade closing direction bias by the shutter actuator is released so that the shutter is brought into the opened state by the spring 246. As such, the state returns to the photographing ready state.

[0089] When the power switch is turned OFF in order to bring the camera into the unused state, the shutter actuator performs bias hold of the shutter blade in the closed state. Then, the mirror drive gear 232 rotates in the direction opposite the arrow 233. Then, the release pin 260a pushes the holding lever end so that the holding lever tip performs closed state hold of the shutter blade. Then, when the mirror goes up, light shielding by the mirror is stopped. The lens is accommodated into the space from which the mirror has retreated. Then, power to the shutter actuator is stopped so that a series of actions are completed.

[0090] As described above, the closed holding means is linked

with the mirror part for performing light shielding to the film. Thus, the drive of the mirror and the closed hold and the release of the shutter are appropriately linked and performed so that light shielding is performed reliably.

[0091] According to the fifth through the seventh embodiments described above, means is provided for performing closed hold of the shutter blades in the closed state when the camera is not used. This ensures light shielding to the film plane when the camera is not used. Further, the holding means is mechanically linked with the power switch, the lens tube retraction, and the mirror. This permits reliable light shielding regardless of power source disturbance (battery exhaustion and battery removal).

[0092]

[Effects of the Invention] As described above, according to the invention, in a shutter apparatus for a camera provided with a shutter blade driven by shutter blade opening and closing driving means so that the shutter blade opens and closes an optical path of an object image, locking means for locking the shutter blade in a closed state and/or an opened state is provided so that the shutter blade opening and closing driving means performs lock and lock releasing of the locking means. This reduces the power consumption and avoids deformation in a shutter

actuator coil in a photographing ready state and the like.

[Brief Description of the Drawings]

[FIG. 1] FIG. 1 is a perspective view showing a first embodiment of the invention.

[FIG. 2] FIG. 2 is a perspective view showing a modification of an embodiment shown in FIG. 1.

[FIG. 3] FIG. 3 is a perspective view showing another modification of an embodiment shown in FIG. 1.

[FIG. 4] FIG. 4 is a perspective view showing yet another modification of an embodiment shown in FIG. 1.

[FIG. 5] FIG. 5 is a perspective view showing a second embodiment of the invention.

[FIG. 6] FIG. 6 is a perspective view showing a modification of an embodiment shown in FIG. 5.

[FIG. 7] FIG. 7 is a perspective view showing a third embodiment of the invention.

[FIG. 8] FIG. 8 is a perspective view showing a modification of an embodiment shown in FIG. 7.

[FIG. 9] FIG. 9 is a perspective view showing another modification of an embodiment shown in FIG. 7.

[FIG. 10] FIG. 10 is a perspective view showing a fourth embodiment of the invention.

[FIG. 11] FIG. 11 is an enlarged perspective view of the main

part in a fourth embodiment of the invention.

[FIG. 12] FIG. 12 is a view showing a modification of a circuit used in a fourth embodiment of the invention.

[FIG. 13] FIG. 13 is a perspective view showing a fifth embodiment of the invention.

[FIG. 14] FIG. 14 is a perspective view showing a modification of a fifth embodiment of the invention.

[FIG. 15] FIG. 15 is a perspective view showing a sixth embodiment of the invention.

[FIG. 16] FIG. 16 is a perspective view showing a seventh embodiment of the invention.

[FIG. 17] FIG. 17 is a view describing the operation of a seventh embodiment of the invention.

[FIG. 18] FIG. 18 is a perspective view of a prior art shutter mechanism.

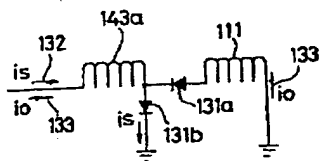
[FIG. 19] FIG. 19 is a sectional view of a prior art tube retraction type camera.

[Description of Symbols]

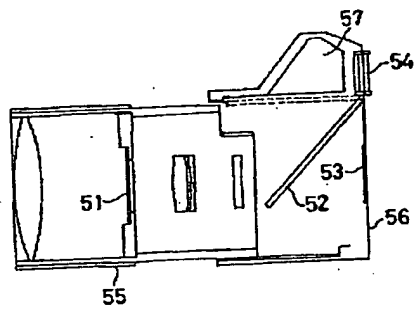
- 11     Closed locking lever
- 16     Elastic lever
- 16a   Spherical protrusion.
- 19     Shaft
- 21     Inhibition bar

22 Plunger  
23 Lock inhibiting means  
41a, 41b Shutter blade  
43 Shutter actuator  
60 Lock pin  
61 Elastic member  
64 Magnetic member  
65 Permanent magnet  
111 Shape memory alloy member  
112 Locking lever  
113 Lock pin  
121,122 Extending direction changing pin  
125a, 125b, 126a, 126b, 127 Guiding means  
213 Power switch  
217 Holding lever  
260 Mirror drive pin  
261 Stopper  
265 Release lever

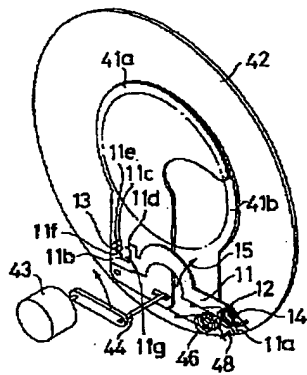
**Fig.12**



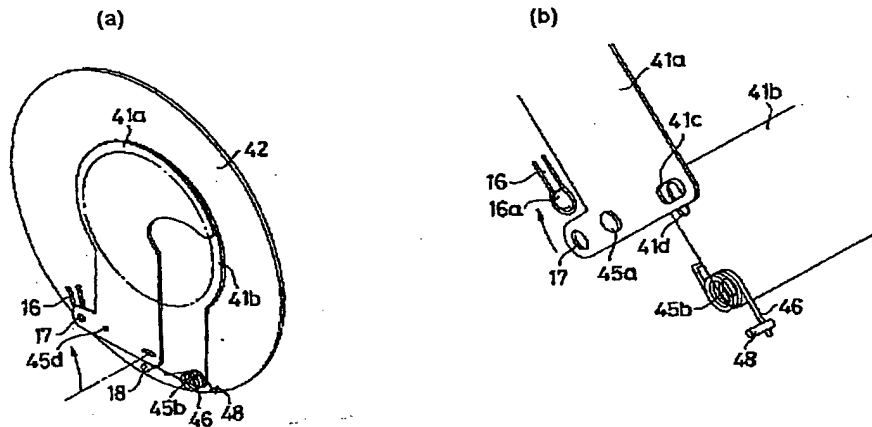
**Fig.19**



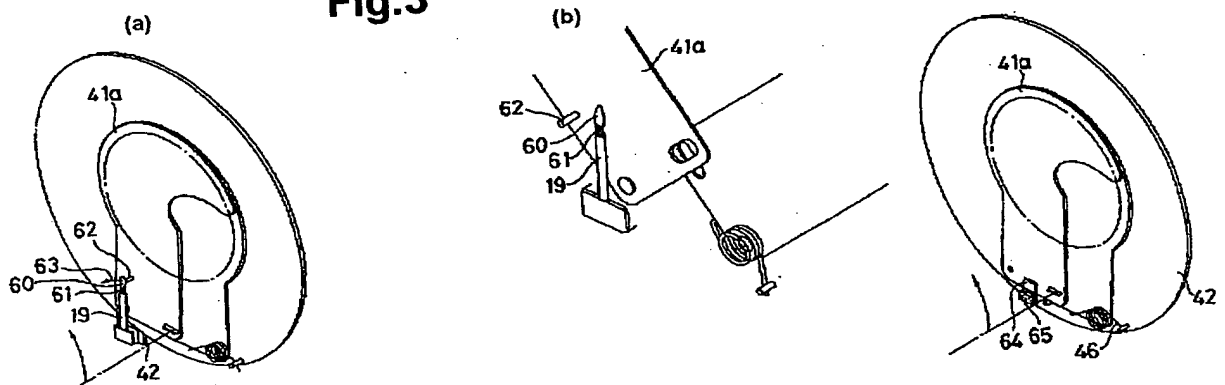
**Fig.1**



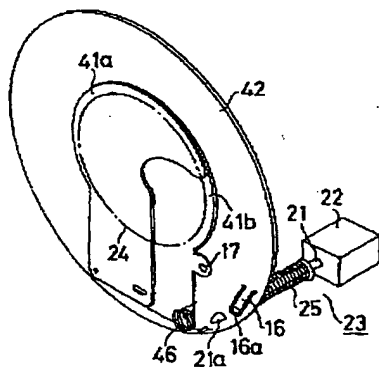
**Fig.2**



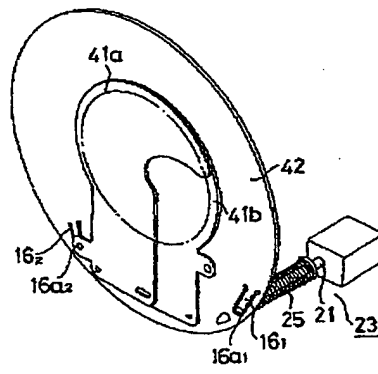
**Fig.4**



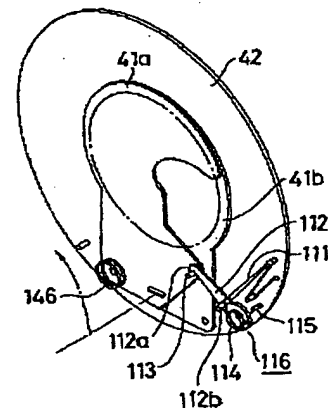
**Fig.5**



**Fig.7**

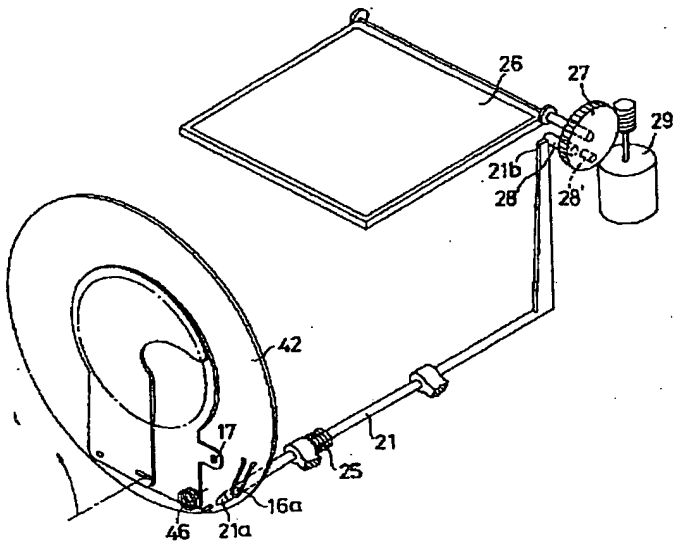


**Fig.10**

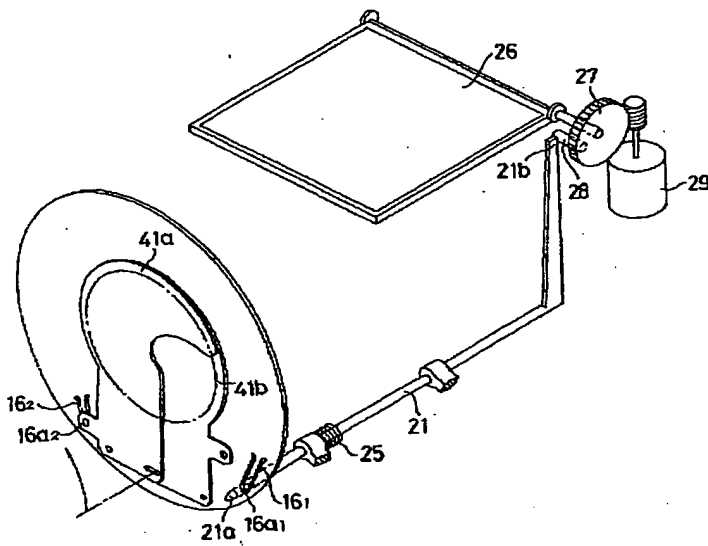




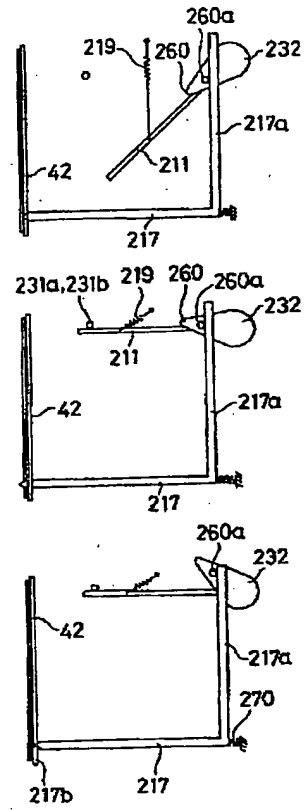
**Fig.6**



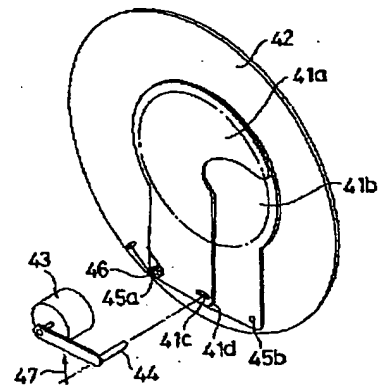
**Fig.8**



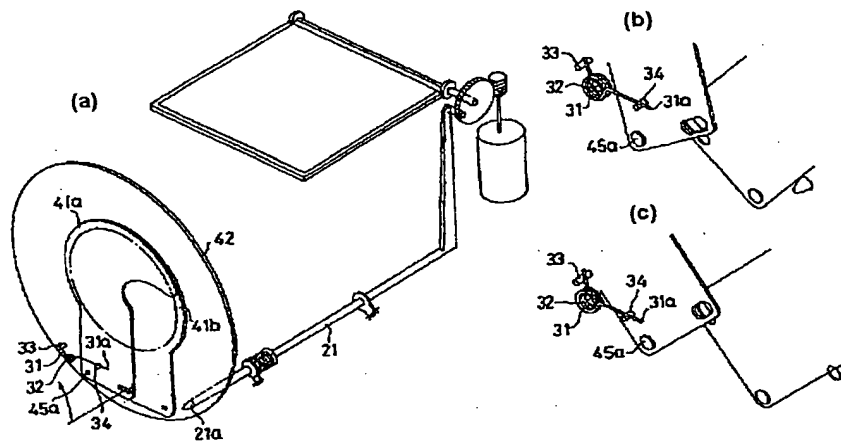
**Fig.17**



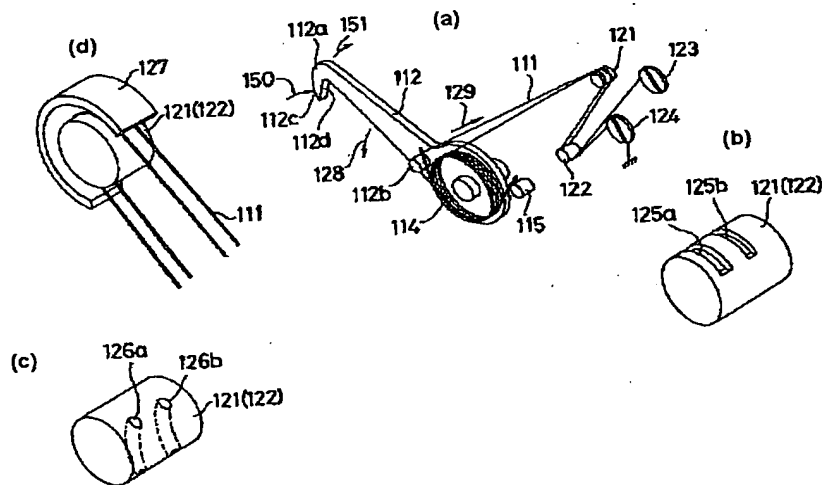
**Fig.18**



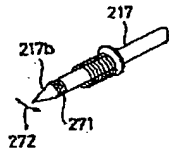
**Fig.9**



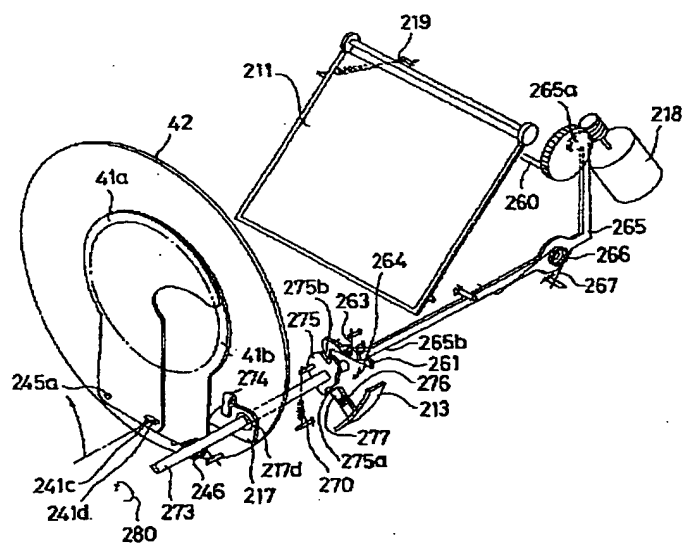
**Fig.11**



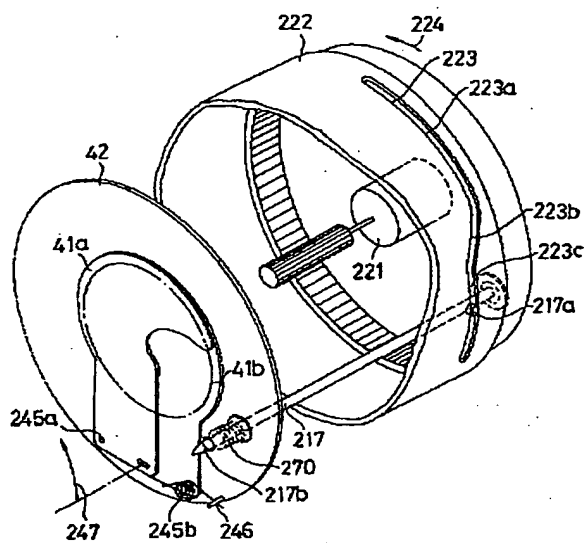
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**Fig.14**



**Fig.15**



**Fig.16**

